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ABSTRACT

Presented are guidelines and strategies for community-level energy education. The main emphasis is upon practical self-help activities in the classroom and the community. The guidebook has three major sections. Section I provides an overview of types of energy education programs and presents models for project development and curriculum planning. Section II contains an overview of energy audit procedures for school facilities as well as descriptions of 18 classroom and community activities. The approaches discussed focus primarily upon the possibilities for local anti-poverty organizations, Community Action Agencies in particular, to undertake program efforts by themselves or cooperate with local schools in offering presentations, workshops, site visits, and community outreach projects. (Author/WB)

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ENERGY EDUCATION GUIDEBOOK

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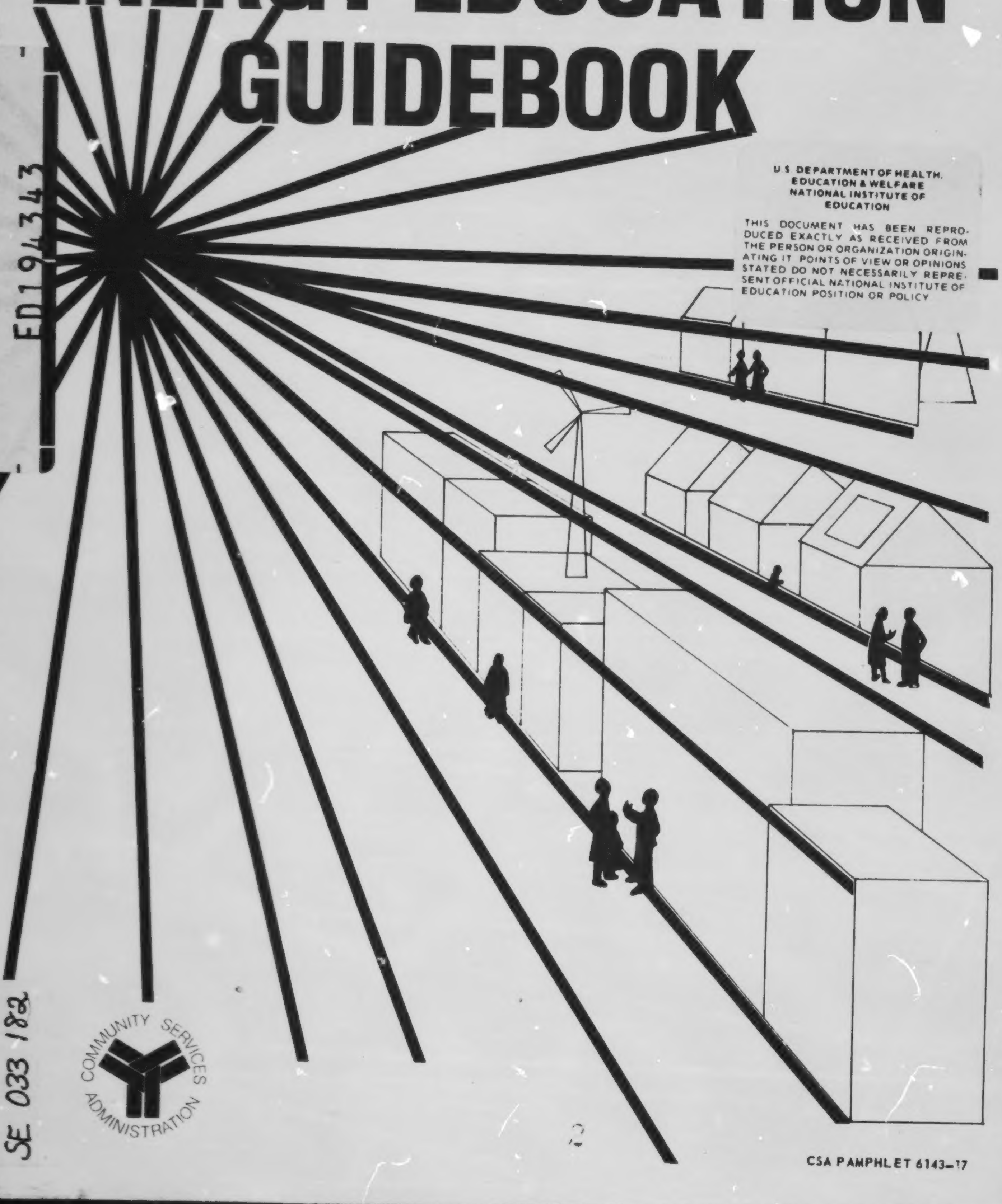

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COMMUNITY SERVICES ADMINISTRATION

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ENERGY EDUCATION GUIDEBOOK

Additional single copies of the Energy Education Guidebook are available free from:

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INTRODUCTION

Across the land, many concerned citizens are trying to save energy in their homes and communities. A number of groups, working through schools and local organizations, have developed innovative energy education programs involving students. Their efforts concentrated on energy conservation and small-scale renewable energy applications in the home and at school. This guidebook describes what they have learned, and provides information about federal, state and local networks of energy education activities which has emerged in the last few years.

Of all citizens, low-income Americans feel the worst effects of the energy crisis, because of rapidly escalating costs for basic household energy. At the same time, the energy field represents one of the best opportunities for meaningful youth employment and training. Thus, the models presented in the Guidebook for starting local educational programs were focused primarily on the possibilities for local anti-poverty organizations, such as Community Action Agencies (CAAs), to link up with schools in their immediate area. This link would allow CAAs, with their practical household weatherization experience, to work cooperatively with primary and secondary schools on curriculum development, local demonstrations of energy conservation and small-scale renewable energy sources and other community education activities. The main focus is on practical self-help oriented activities in the classroom and the community. These can involve students, parents, teachers, and community organizations working together for everyone's betterment. Work-study opportunities for young people have also been described as one approach.

The Guidebook is divided into three major sections. Section I provides an overview of the types of local energy education activities now under way and provides models for starting a local project and developing a curriculum plan. Section II contains an overview of energy audit procedures for school facilities as well as descriptions of 18 educational activities which can be undertaken in the classroom and in local community education efforts. These 18 activities have been divided into three levels of complexity, depending upon the skills required. Section III contains a list of projects, a listing of potential funding sources, an annotated bibliography, and a list of training and technical assistance resources.

Additional copies of the Guidebook can be obtained from the Office of Energy Programs, Community Services Administration, 1200 19th Street, NW, Washington, DC 20506.

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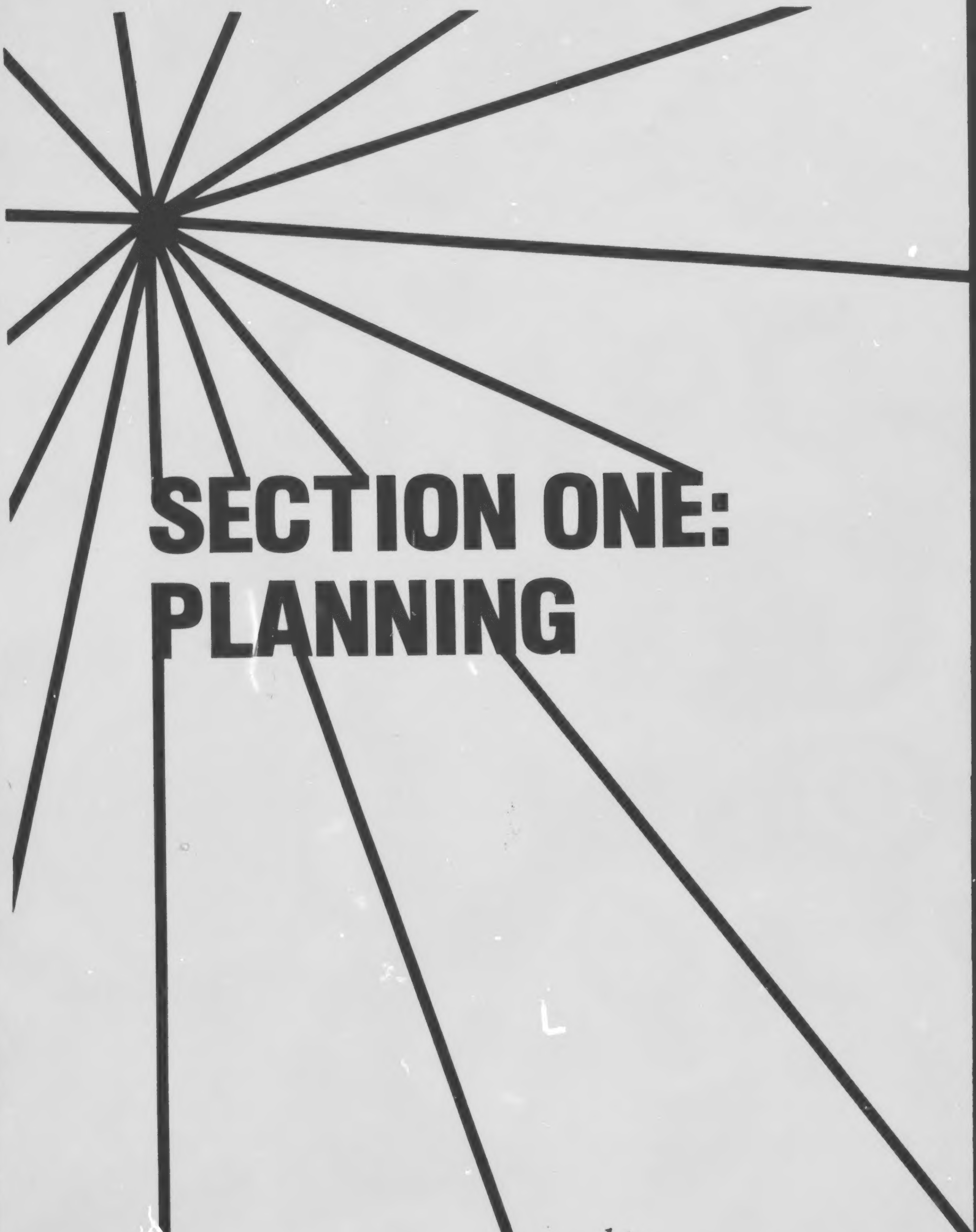


SECTION ONE: PLANNING

CHAPTER I

OVERVIEW OF ENERGY EDUCATION

A. INTRODUCTION

The purpose of this chapter is to introduce readers to the field of energy education. It first describes the broad scope of current energy education efforts, drawing on descriptions of representative projects. It then discusses the need for and goals of energy education programs, and the key strategies that will assist readers to achieve their project goals. It also presents two program models which identify the primary participants - community action agencies (CAAs) and schools - and such secondary participants as junior colleges, unions, community groups, and energy-related research and development, and training and technical assistance organizations. It also introduces the role CAAs can play in coordinating community education outreach with public school energy education efforts.

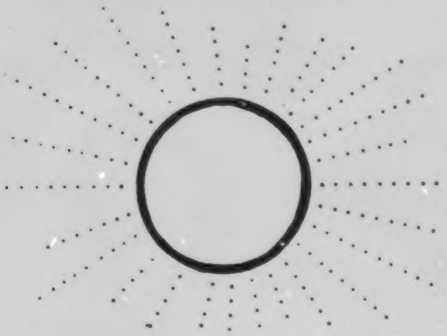
B. ENERGY EDUCATION: SCOPE OF ACTIVITY AND TYPES OF PROJECTS

In their attempts to increase student, family, and community energy awareness, energy education projects, supported by the Community Services Administration, include a wide variety of project-supporting activities, of which the following is an overview. A list of approximately fifty energy education projects contacted for this Guidebook can be found in Chapter VI.

At a basic level, CAA energy education projects offer lectures on local, regional, and national energy needs to interested school classes and/or assist local school teachers in planning similar class talks. The majority of projects which have involved lectures also have included simple hands-on demonstration projects as part of the presentation. Examples of such devices include simple beer can solar collectors, solar hot dog cookers, solar window-boxes, and solar food dryers. Many of these projects have been conducted at CAA sites.

- In Havre, Montana, the District 4 Human Resources Development Council (HRDC), has developed a project which involves extensive lecturing on energy and the building of simple demonstration home improvement projects in the schools by one CAA-based circuit-rider, who has visited more than 24 schools and 2,600 students. This project is funded by the Community Services Administration (CSA).

- The Economic Opportunity Commission of Nassau County, Inc., New York, has sent speakers to local schools to talk about energy conservation and solar energy, including showing films and/or slides, distributing information packets, and presenting and discussing a model solar energy building. This project also emphasized the job and career development aspects of the current energy situation.



Other projects have taken students on site visits to demonstrate a variety of energy sources and applications, including trips to weatherization project sites, model solar homes, and electrical energy generating plants.

- In Wilkesboro, North Carolina, students visit the demonstration solar home of the Blue Ridge Opportunity Commission.

- Students in San Mateo, California, visit the San Mateo Development Center's energy demonstration house and weatherization project sites.

Many projects have either conducted or consulted to develop basic energy skills workshops, either in schools or at the CAA site. The workshops involve training in such weatherization skills as weather-stripping, caulking, making energy audits, and installing various types of insulation. These projects may train students in the building and installing of box heaters, emphasizing related carpentry and construction skills. Participants in such projects are frequently active in developing renewable energy installations in their own or others' houses.

- In Upland Hills, Michigan, 50 elementary and junior high school students from the Upland Hills Farm School have helped to build, install, and maintain solar hot water heaters, two windmills, solar cookers, and a solar greenhouse. Students and their families also built the Upland Hills Ecological Awareness Center. The Center is a 1800 sq. ft. solar heated and wind powered building. Tours and energy workshops are conducted as well as recreational activities. This private school is a largely energy self-sufficient complex and includes energy studies and design as an integral part of its curriculum. It is funded largely through tuition payments from the students' parents, although the affiliated Ecological Awareness Center was in part funded by private donations, the Motor City Consumers Coop, and the Mott Foundation.

- In Utah, the State Department of Education, in collaboration with Energy and Man's Environment, a private consulting organization, has conducted teacher training workshops in which 5,000 students have acted as community energy canvassers. Thus far, these students have contacted about 25,000 homes in the state. This project is funded by the Utah State Department of Education.

Some projects conduct training in advanced energy skills. These may involve construction and/or installation of solar hot water heaters, construction of houses and institutional buildings with passive solar applications, design and construction of solar collectors and related construction, plumbing, ventilation, and electrical skills. This training is conducted at CAA sites, on the job, or at school.

- In Laramie, Wyoming, 15 school children affiliated with the Cheyenne County CAA participated in the design and construction of a National Demonstration Project Solar Greenhouse. Lectures are given on these activities in the county and statewide. This effort was funded in part by CSA and by the Comprehensive Employment and Training Act (CETA) program of the Department of Labor.

- In Omaha, Nebraska, 110 young adults affiliated with a program jointly sponsored by Greater Omaha Community Action (GOCA) and Metropolitan Technical Community College participated in two programs. Forty were active in a G.E.D. program leading to a high school diploma, in which basic solar design and installation skills were taught. Fourteen GOCA trainees graduated from this program. GOCA energy-related activities were financially supported by CSA, CETA, with technical assistance provided by the Metropolitan Technical Community College.

Projects also engage in a variety of public awareness and community outreach activities disseminating energy-related information through the media, conducting public workshops, holding energy poster contests, producing energy public service announcements for radio and television and participating in and holding community energy fairs.

- Community Services of San Bernardino County, San Bernardino, California, presents life-sized puppets in energy shows to local schools and have played to approximately 7,500 students monthly. The show's theme centers on saving energy.

- Students from the James Buchanan High School, Mercersburg, Pennsylvania, conduct community surveys to determine what energy-saving techniques the public is interested in, hold energy fairs, and have demonstrated their activities in the U.S. Capitol Building, Washington, D.C.

- The Lake County Advancement Opportunities, Inc., Ronan, Montana, presents slide shows on its energy activities to local groups and the general public, including the Northwest Montana Real Estate Appraisers Association.

- The New Western Energy Show, Billings, Montana, visits public and private schools on eastern Montana Indian reservations, using theatrical and musical materials in presentations specially designed to increase the students' interest in renewable energy.
- The Clackamas Community College, Oregon City, Oregon, through its Energy Information Access Center, networks information on energy conservation and energy alternatives.

C. ENERGY EDUCATION: OVERVIEW OF NEED, GOALS, STRATEGIES

1. The Need for Energy Education Programs

A major effect of the energy crisis of 1973-1974 was to make clear the general lack of energy awareness among American citizens and the need for federal, state, and local energy education programming initiatives. As long as Americans could get all the energy they needed easily and cheaply, there was no need to question the basic assumptions that underlie the petroleum age and the anticipated nuclear age. With the imposing of the Arab oil embargo, fuel shortages occurred and prices soared. Since 1973 fuel prices have quintupled and continue to rise steeply. At the same time, the promise of nuclear development has not been realized. The country has had to wrestle with an entirely new range of energy realities and problems. Among the many responses to the energy crisis has been the realization that, faced with overall necessity to engage in greater energy conservation on the one hand, and develop new energy resources on the other, Americans would need to become educated about energy matters if they were to contribute to the development of appropriate policies and programs.

Although energy education efforts did get under way nationally and locally in the aftermath of the energy crisis, those programs were generally not targeted to the needs of low-income families, schools, and communities. It was the American poor and elderly who have been most severely affected by the energy crisis. They pay a higher proportion of their gross income for energy than the middle class. In fact, sharply rising utility costs have limited the ability of the poor to pay for other essentials such as food, rent, and clothing. In many cases, the poor cannot respond to higher utility costs by reducing their already essential energy consumption without grave risks to health.

In addition to residential energy use, marginal low-income family farms are largely dependent on fossil fuels for transportation and the operation of farm tillage and other machinery, and for the production of nitrogen fertilizer and farm chemicals, the increasing costs of which are forcing many off the farm.

A similar situation faces marginal low-income small businesses, many of which are falling into bankruptcy.

In schools in low-income communities where high fuel prices constrain operating budgets, there is a real need to take advantage of recent advances in the applied science of energy conservation. At present, these schools do not have the overall resources and expertise to develop this energy conservation capability independently. Lastly, from a community development perspective, there is also a clear

need to involve students from poor neighborhoods in the developmental process of solving local energy needs together with CAAs. Students and schools need to develop public information and community outreach skills to participate as energy problem-solvers and develop new job and career opportunities.

2. The Goals and Benefits of Energy Education Programs

In the aftermath of the oil crises of 1973-74 and 1979-80, and the natural gas shortage of 1976-77, it has become clear that the nation's energy problems could not be solved without major educational efforts aimed at all segments of the population. Accordingly, federal, state, and local governments, academic institutions, and concerned individuals and organizations have begun to develop and implement a variety of energy programs. Those for low- and middle-income citizens, communities, and community based organizations have focused on crisis intervention and weatherization assistance. From these efforts has developed the realization that people need information and skills in order to be capable of solving their own energy-related problems. Recently, CAAs and schools have begun cooperating on the development of pilot programs to provide energy-related education to students, their families, and communities.

The chief goal of these energy education programs is to increase awareness among low- and middle-income people about the need for and usefulness of energy conservation measures and renewable energy resource applications. The basic approach is to implement energy education programs specifically targeted to students K-12. This basic goal may be accomplished by:

- Educating students in both the principles and skills that are related to home weatherization improvements and small-scale renewable energy applications, including giving students experience in carpentry, construction, and other energy-related activities. These will benefit the students by enabling them to demonstrate energy applications in daily life at school, home, and in the community, and also broaden their job and career development opportunities;

- Educating students in the broad range of solar energies, including alcohol fuels, biomass, water power, geothermal and photovoltaics;

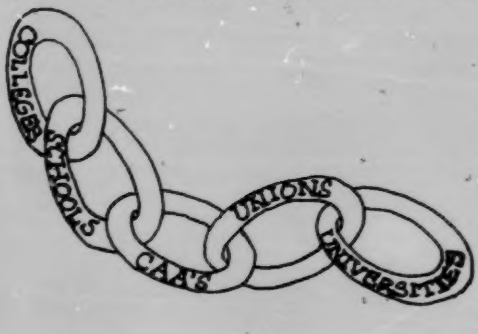
- Educating schools and communities about the broader socio-political context in which energy conservation and solar efforts are taking place, including discussion of current energy technologies versus solar and conservation in terms of corporate control, environmental pollution, decentralization, economic equity, and costs. Basic questions include why solar is not more widely commercialized now and what role students could play in order to change that situation;

- Providing appropriate technical, financial, and material resources to low-income schools to assist them to do energy audit and energy conservation projects in the school and thus to gain useful experience in these areas, eventually leading to significant fuel consumption reductions and corresponding cost savings;

- Raising community awareness about these opportunities via outreach activities undertaken by the students participating in this educational program;

- Providing financial, technical, material, and informational resources to assist low-income communities to solve their energy-related problems, gain valuable experience, and increase their local problem-solving capacity;

- Encouraging local CAAs to use both their weatherization experience and linkage to the local school system to expand the constituency which they serve. With improved community outreach and technical capabilities, the CAAs could increasingly become the focal points for community efforts to solve vital energy-related problems. This may provide a useful public relations mechanism for CAAs to increase their standing in the community and build a sound basis for future programming;



- Developing useful linkages with participating organizations and agencies, primary and secondary school, junior colleges, colleges, universities, and unions, in order to develop and extend effective programs, make the fullest use of local resources, and provide future job opportunities for student participants.

3. Appropriate Strategies for Energy Education

The development of strategies for energy education programming is a very important element to be considered by interested readers. A strategy is a basic approach to achieving a program goal. Here is a simplified overview of general energy education goals and basic strategies:

General Program Goal	Basic Strategy
● Increase the students' energy awareness, knowledge, and skills.	● Involve the students in practical, productive, hands-on activities in energy conservation and renewable energy applications.
● Increase family energy awareness and knowledge.	● Involve the students and their families in simple, interesting, and informative activities relating to home energy needs.
● Increase community energy awareness and knowledge	● Involve students in the preparation and dissemination of information and the performance of energy conservation and renewable energy activities directly related to community energy problems.

As for the rationale of this basic program strategy, energy education program feasibility and evaluation studies make clear that energy education programs oriented to upper-middle economic communities are likely to be unsuccessful when attempted in low- and middle-income areas.* In many ways, these programs do not meet the needs of these communities and often employ inappropriate strategies.

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*See Energy and Education: A Report on the Feasibility of Such Programs for Low-Income Students and Communities, a study submitted to the Community Services Administration, Washington, D.C., by Design Alternatives, Inc., December, 1978, 41 pp.

Energy education programs which attempt to employ strategies appropriate to the needs of low-income communities characteristically promote hands-on practical activities, supported by teaching about the regional, national, and international energy situation and its implications. Students may spend most of their time learning to build and/or install energy-conserving and renewable energy devices. Many of these students are then motivated to apply at home and in the community what they have learned at school. Appropriate strategies in low-income schools are carefully structured, in order to be comprehensible to young people with limited reading skills. Many of the best programs start with in-school lectures and demonstration projects and work up to basic energy skills developed through on-the-job training. In turn, this may someday provide entry into more advanced energy training opportunities, union apprenticeship programs, and junior or 4-year college programs in energy-related fields.

D. ENERGY EDUCATION PROGRAM MODELS

Here are two implementation models for energy education projects in low- and middle-income communities. They have been developed in large part from analysis of the current projects described in Chapter VI. Those who are interested in developing energy education projects are encouraged to explore that list of projects and contact those that may provide useful information and insights into energy education.

1. A Model for CAA and School Collaboration

Model 1 assumes that a local CAA, experienced in energy-related programming, working with a local school such as a primary, secondary, vocational or special purpose school, can develop an active and cooperative relationship to do special presentations, workshops, laboratory work, site visits, and special community outreach projects with students, their families, and communities. CAAs could especially assist schools to do energy audits. Through this collaboration, the CAA/school team could develop a more extensive series of workshops and classes, focused on energy conservation and solar installation activities. It would also develop a basic training program, potentially including a work-study component, in which students could receive energy-related training while working for organizations and agencies which are trying to solve community energy problems. Multi-disciplinary curricula, being developed by a variety of public and private organizations and agencies, could be used in part (see Chapter VII). In its advanced stages, the model assumes that the CAA and the school can cooperate to develop projects and resources for energy-related educational and job counseling.

2. A Model for the CAA as an Independent Actor

This model assumes that the CAA will undertake the majority of program activities by itself. Thus the CAA would give special presentations, workshops, and related activities to local public schools, throughout the community, to local organizations involving young and old people, at alternate schools, and on an ad hoc basis through demonstrations and fairs in parks, streets, and shopping centers. Since the concentration of youth in a particular school may not be continually available for CAA programming, the CAA might decide to adopt a wider scope of activities in working with students. In this model, the CAA might develop a more extensive series of workshops and/or a basic vocational training program, possibly in work-study programs either after school or on weekends. Or a CAA could concentrate on certain aspects of high school equivalency training for dropouts with on-the-job training related to the CAA's weatherization program.

3. Implementation Stages

Even with the maximum available assistance, the fully implemented program model may require skills that could strain the capabilities of CAAs. The skills necessary to teach how to build and install relatively complicated solar devices, for example, are not well developed everywhere. It is not expected that CAAs and schools implement the full range of energy-related activities. It is actually much more practical and realistic for potential projects to consider the following developmental stages, concentrating work in the one which would permit the learning program time to develop the capabilities and resources to do the next. For example:

Implementation Stage	Appropriate Activities
1	In-school CAA-sponsored lectures; in-school teacher-sponsored lectures; community awareness workshops; visits to demonstration sites.
2	In-school/CAA site basic energy skills development workshops, including introductory work with demonstration models of energy conservation and renewable energy applications.
3	In-school/CAA site advanced energy skills training, including building demonstration models; in-school/CAA site advanced energy conservation skill development.
4	Project participants installing weatherization/appropriate technology devices: in their own homes; in unrelated people's homes; in institutions.

Here are descriptions of these key activities:

- Lectures: Almost all of the energy education projects present lectures to groups and/or classes on energy-related topics. Without a doubt, this is the time-tested and direct way of communicating information to students and will most likely continue to be a relatively effective approach. Lectures can be used to discuss such topics as basic energy principles; the concepts behind appropriate energy technologies; the local, regional, national, and international energy situation; and the principles of energy conservation. Lectures may be made more effective if accompanied by relevant audio-visual presentations.

- Workshops: Many energy education projects feature energy-related workshops as a basic component. Workshops may incorporate lectures and include other activities as well; they usually involve:

  - the presentation of energy-related background information to students, parents, and community residents, through such vehicles as lectures, films and slides;

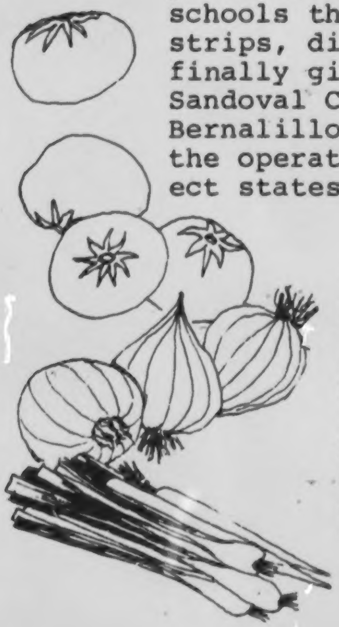
  - the demonstration by the instructor of certain key energy-related principles and/or skills;

  - the performance by the audience/participants of specific exercises designed to teach and reinforce these principles and/or skills; and

  - the response of the instructor to the participants, on an individual or small group basis, assessing their performance and proving constructive feedback, and drawing the workshop to a close.

Workshops are usually of short duration, ranging from a few hours to a day. From the point of view of the complexity of the material to be presented, workshops may be basic or advanced. Basic workshops, which may cover stages 1 and 2, present introductory-level material and exercises. For example, the El Dorado Community Action Council, Placerville, California, presents workshops in third and fourth grade elementary schools that are based on showing "Energy Ant" filmstrips, discussing the film with the children, and finally giving them "Energy Ant" coloring books. The Sandoval County Economic Opportunity Commission, Bernalillo, New Mexico, offers advanced workshops in the operation and management of greenhouses. The project states that:

> The students will be able to work in their own greenhouse, learning the basic principles of operating a greenhouse for food production and how a unit adds heat to the home. The students will also learn how simple devices, such as the convective-loop heaters work to provide heat for the home. In addition to these basic immediate impact areas, the students will learn more about energy conservation through the long term exposure to solar heaters.



- Site visits: These are simply trips by individual students, small groups, or entire classes to specific energy-related sites to broaden the students' experience. Site visits can be made to local, regional, and national points of interest and can vary in duration accordingly. Site selection should be based on specific curriculum goals and activities. Examples of actual site visits and strategies for making the best educational use of them are presented in Chapter V.

- Demonstration models and sites: Demonstration models are working models of actual energy devices. For example, some projects use scale models of solar collectors for classroom teaching purposes. Other projects teach their students to build working scale models of such devices. This guidebook presents scale model building activities involving such devices in Chapter IV.

4. Community Outreach Activities

In each of these stages, students can conduct energy-related family, community outreach and public information activities. Each developmental stage of the program may be paralleled by equivalent stages in outreach activities and events. Thus stages 1 and 2 might be paralleled by informal energy education activities conducted by the students with their parents, relatives, and neighbors, while stages 3 and 4 might include more extensive activities. Energy education projects report that manual activities are the ones that most motivate students. Many public information/community awareness efforts could be initiated making use of various media formats and attention-getting schemes to reach several audiences in the community effectively. These projects, which are described in detail in Chapter VI, include public service announcements, energy poster contests, mobile energy demonstrations, and theatrical productions, and work with community groups on decision-making events and processes. For a description of community energy awareness activities, see Reaching Up, Reaching Out, a guide to organizing local solar events prepared by the Solar Energy Research Institute, Golden, Colorado (Chapter VIII, p. 216).

5. Primary Program Participants

Community Action Agencies and the public schools, K-12, are the primary actors in this program. Here are brief descriptions of their basic roles:

- CAAs: The primary roles of the CAA are:
  - to serve as an expert organizer and consultant on energy matters;
  - to develop a program using the school's resources;
  - to develop jointly with the school advanced training programs;
  - to act as a liaison with schools;
  - to seek outside assistance where needed.
- Schools: The basic roles of the school in this program are:
  - to act as a center in which young people and other community residents may participate in energy awareness activities;
  - to provide the benefit of its experience in teaching and curriculum development toward structuring the more extensive practical experience of the CAA for the benefit of students of various ages;
  - to act jointly with the CAA to develop advanced programs;
  - to seek outside assistance.

6. Secondary Program Participants

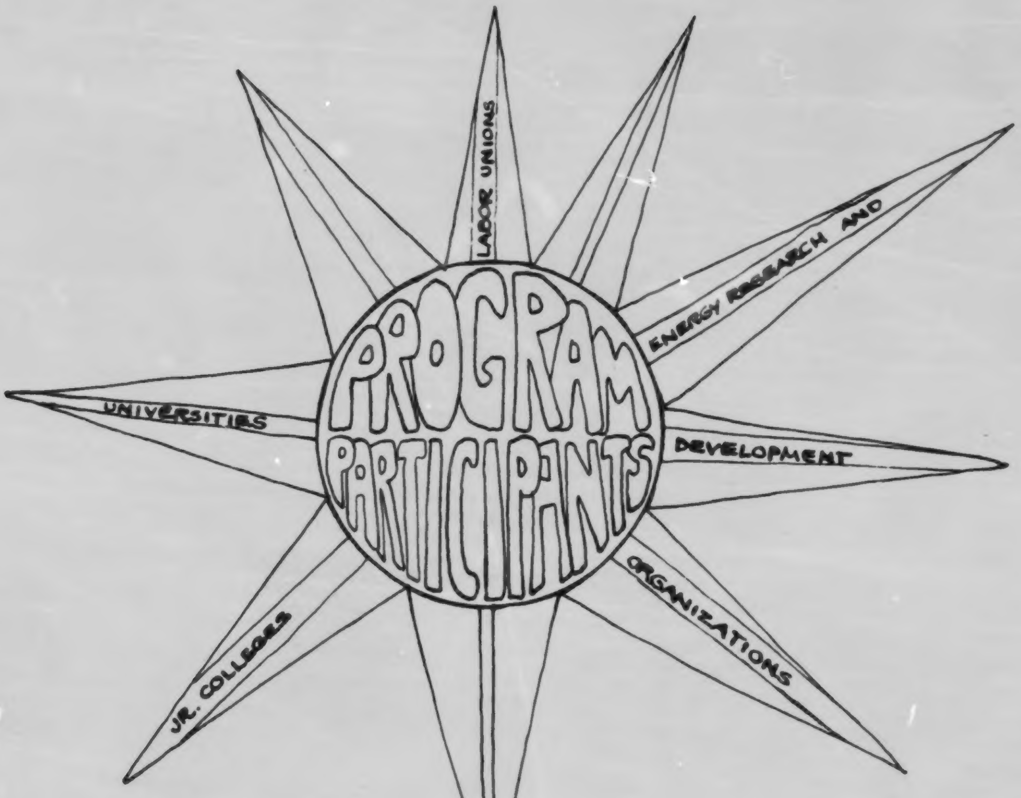
This program could have at least these potential secondary participants: universities or community/junior colleges; private and public non-profit research, training, and technical assistance organizations; and labor unions. These secondary participants could play supportive roles in energy education projects by virtue of their interest, expertise, and resources. They might provide technical assistance where necessary; give workshops for staff development and training; and extend opportunities for job development, apprenticeship training, or further education for trainees. Here is an overview of how such organizations and agencies could assist in the development of energy education projects:

- Universities may assist projects by providing training and technical resources, and supply expertise in the fields of program design and development, faculty development, and program evaluation. Universities may provide energy-related assistance on an ad hoc, workshop, or seasonal basis (e.g., summer). University assistance will most likely take the form of a consulting relationship. Universities should not be expected to provide full-time program staff, but they may be willing to provide undergraduate or graduate student volunteers. In rural areas, land-grant universities are likely resources that energy education projects could tap for expertise and resources. In urban areas, those private denominational colleges with developed social missions, progressive colleges, or individual departments/faculty members in large university complexes may also be likely resources.

- Community or junior colleges also offer a potentially broad range of resources to projects. They could advise on education and student motivation, particularly when a CAA is undertaking a project without the participation of a school. They might also provide technical assistance in developing more advanced elementary and secondary programs. Two-year colleges can assist in energy-related career development planning by establishing programs where students involved in energy training at the secondary level might receive more advanced training, college credits, and degrees. Community and junior colleges are also well placed for the development of community outreach and public information projects on energy. See Chapter VIII for a list of such institutions involved in the provision of energy-related assistance.

- Energy research, training, and technical assistance organizations, both private and public, may provide technical assistance on hardware and program development, information about other energy education programs, and information on sources of funding for energy education projects. Like the university, they play a support role. Unlike most universities, these organizations may have extensive technical expertise in energy applications. Citizens' Energy Project (Washington, D.C.), Ecotope Group (Seattle, Washington), the National Center for Appropriate Technology (Butte, Montana) and the Solar Energy Research Institute (Golden, Colorado, are all examples. (See Chapter VIII.)

- Labor unions may provide technical assistance to energy education projects in the specific area of job skills training and also may supply skilled retired or currently unemployed members to train young people. Union involvement might also provide the trainee an opportunity to join an apprenticeship program on the completion of secondary school. Additional information on the recruitment of these secondary actors is presented in Chapter VI.



CHAPTER II

PROJECT DEVELOPMENT: STEPS, ISSUES, AND STRATEGIES

A. INTRODUCTION

The purpose of this chapter is to help readers achieve their energy education project goals by focusing on project planning. It is especially oriented to CAAs and similar organizations that wish to start such projects and, to a lesser extent, personnel working in existing projects who may want to improve and/or expand their operations. The chapter identifies the basic planning steps that project managers should undertake, identifies outstanding issues and problems that recent and current projects have reported, and presents appropriate project strategies. Here are the major planning steps:

- Deciding to participate;
- Establishing feasible project goals;
- Obtaining school participation;
- Developing a work plan;
- Recruiting secondary participants;
- Monitoring and evaluation.

1. Deciding to Participate

The first step in undertaking an energy education project, i.e., developing an interest in this field, may come about in several ways. Many CAAs initiated such projects as an extension of their successful efforts to meet local needs through projects in weatherization, consumer energy education, and utility rate reform. Other experience, such as job development, housing rehabilitation and house construction may also stimulate the interest of a CAA toward energy education. Some CAAs, with extensive experience in the field, may encourage less experienced but interested CAAs to participate and provide them with very useful information about project development. Other CAAs may become interested through the announcement of federal, state, and local grant programs, including those of the Community Services Administration (CSA), the Department of Energy (DOE), and HEW's Energy Education Action Center (EEAC).

CAAs are also responding to the recent and significant growth in formal and informal networking, or information sharing, among individuals and organizations working in the field of appropriate energy technologies. Local schools may approach the CAA requesting technical assistance, training, or related aid in the field of energy education. Often the urge to do more in this field develops as a result of the CAA's having given introductory-level presentations in the schools. Most important, the impetus to do energy education may come as a result of the CAA's continuing community needs assessment activities, for there is no doubt that obtaining the necessary energy is a big problem for low-income communities.

Once a CAA is interested in working in this field, it will need to determine the energy needs of the community and the specific types of information necessary to begin to address the community's energy problems. However, it is important to emphasize that this needs assessment does not require an extended technical analysis but is rather an informal yet comprehensive review of the energy problems confronting a particular low-income community. The objective of this step is not to arrive at a definitive analysis of local energy problems but to identify a range of problems, one or two of which a potential energy education project might modestly begin to solve. This is best accomplished through the participation of community people. CAAs could invite community residents to town meetings or similar events to discuss and record energy-related needs. Here are some useful questions for community discussion.

- What do low-income people report to be their biggest energy problems? What other problems do they mention?

- What are the nature, causes, and consequences of these problems?

- How might these problems begin to be solved?

- What kinds of information, education, and skills would be needed to begin to solve these problems?

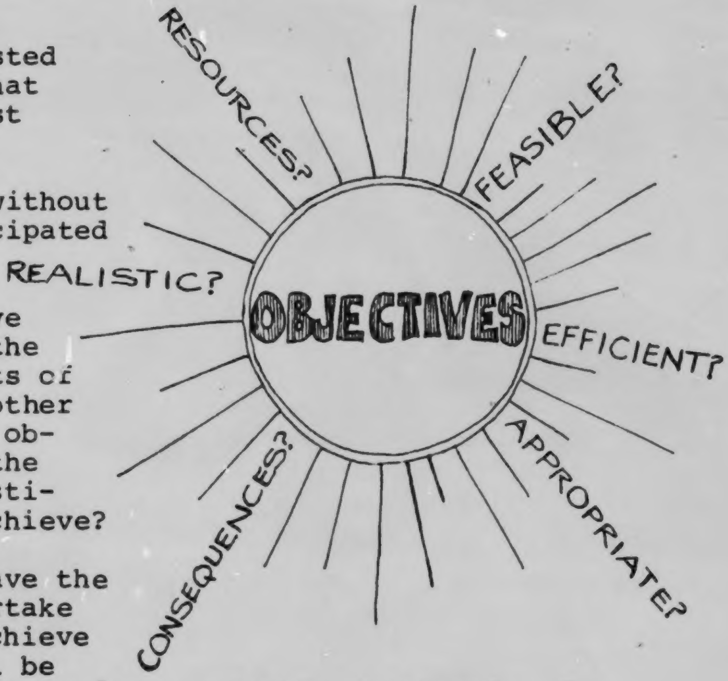
- What kinds of projects might be undertaken by a CAA or a CAA/school partnership to provide the needed information, education, and skills?

- In short, what energy education projects suggest themselves as partial solutions to the problems which the discussion session generates?

2. Establishing Feasible Project Goals and Objectives

Having established a series of community energy needs, project planners are ready to examine what the CAA's contribution to solving them might be. The planners need to develop a range of possible objectives which solve in part those local energy needs. They should then assess those objectives for appropriateness and feasibility. The following questions might serve to stimulate and guide that assessment:

- Is the suggested objective the most appropriate one, given the "need" or "problem" that the community has formulated?



- Does the suggested objective solve that problem in the most efficient way?

- Will it do so without generating unanticipated consequences?

- Is the objective feasible? Given the obvious constraints of funds, time, and other resources, is the objective one that the project can realistically expect to achieve?

- Does the CAA have the resources to undertake the project and achieve its goal? It will be useful for planners to do a resource assessment. In order for the assessment to be both accurate and comprehensive, "resources" should be considered in its broadest application. Resources are anything you use in project-supporting activities and include the material, human, financial, technological, and informative categories.

3. Obtaining School Participants

Having identified and assessed the CAA's capabilities and resources, and having tentatively determined feasible energy education project goals, the interested CAA should next consider whether to work in cooperation with a local school (Model 1) or to undertake a project largely independently (Model 2).

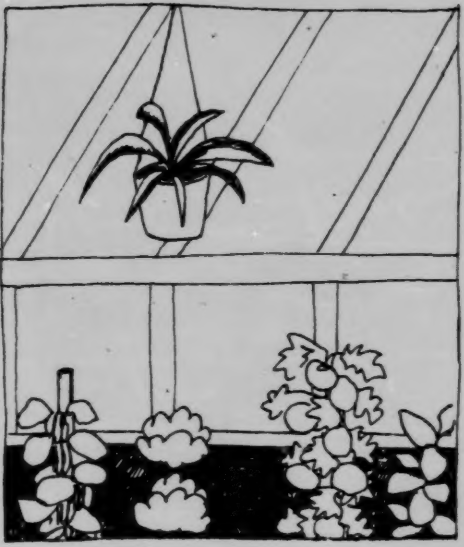
Currently CAAs operate under each model. The choice seems to be based almost exclusively on local factors, including the orientation of the CAA energy project staff, the CAA's resources, the nature and resources of local schools, the orientation and attitudes of school administrations and teachers, and related factors.

The Havre, Montana CAA suggests that very small rural schools with limited teaching staffs may seek an active participation with the CAA, because they are looking for new and challenging activities both for teachers and students.

The People United for Self-Help (PUSH) projects, Phoenix, Arizona, leased a severely vandalized house from the city and turned it into an energy conservation demonstration house where students visit and participate in energy-related workshops. Because the project's resources are focused around the operation of the house, it is more convenient to act independently and receive classes of students from a local high school than it is to engage the school's own resources for energy-related activities.

The Economic Opportunity Commission of Nassau County, Inc. (EOCNC), Hempstead, New York, has put together a solar energy demonstration van which tours schools and other locations, including shopping centers.

Other projects seek to follow Model 1 and actively engage a local school's participation as a primary actor in the program.



The Economic Opportunity Program (EOP) of Chemung County, Elmira, New York, has built a greenhouse into an elementary school which serves as a focus for the school's EOP-assisted efforts in energy conservation, renewable resource applications and agriculture.

The Blue Ridge Opportunity Commission, Wilkesboro, North Carolina, has built a solar greenhouse at Glade Valley School where students do agricultural projects and learn about solar energy.

Readers interested in developing energy education projects should note that the effectiveness of the pilot project may vary according to location. This may affect the selection of a participating school. Urban areas are perhaps more difficult locations in which to establish such networking than are rural areas. Urban CAAs may encounter this problem in attempting to recruit an urban school as a primary participant.

Typically, urban school systems are large organizations which sometimes leads to insensitivity to the needs of their low-income students. They may be centralized systems with complicated procedures for curriculum development and materials approval. The curriculum and teaching preferred in such schools may tend to be formal and traditional, a factor which may make collaboration somewhat difficult but should not prevent it.

In addition, the prospect of school students actively weatherizing school buildings and perhaps engaging in more elaborate retrofitting projects may be initially opposed by school support system personnel. Similarly, the problem of city and school system building regulations, which may require the active involvement of professionals, may also complicate the use of students in school pilot projects and possibly the use of students in school itself as a demonstration project. Insurance may also be a problem.

Having stated the problems that CAAs may encounter, there are some strategies to minimize them and assist in the establishment of cooperative relationships with schools in urban areas. Linkages may be possible between CAAs and decentralized and community-controlled public schools or school districts, or between CAAs and private schools which have an innovative environment, or with public schools that have particularly strong parent involvement. Whichever variant is selected, it is vitally important to gain the approval of the local school board.

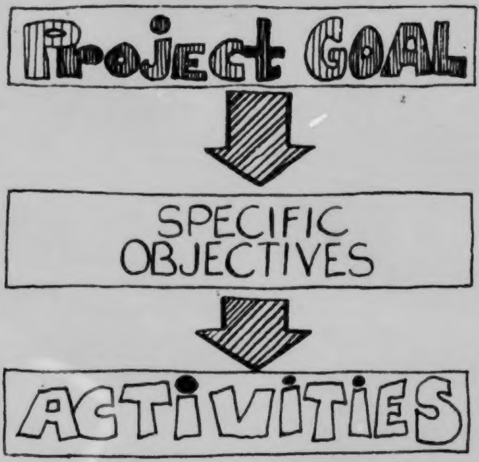
Several urban energy education projects have overcome some of the basic obstacles. In 1977, the Bay Area Engineering Societies' Committee for Manpower Training, Inc. (ESCMT) undertook a DOE-sponsored and funded energy awareness project at the Lakeside Elementary School, Oakland, California, to stimulate the interest of minority students in energy, to create a better understanding of the social and economic impact of energy, and to encourage students to consider energy-related careers. The all-important groundwork activity for the project was laid by the Office of Public Affairs of the U.S. Energy Research and Development Administration (formerly ERDA, now DOE) which had initially gained the approval of the Oakland School District to do a pilot project. Both the DOE funding and the preliminary discussions were important factors which paved the way for the development of the project.

The EOP/Elmira, New York, energy education project also overcame some minor barriers associated with urban schools. Although the EOP gained the enthusiasm of an elementary school principal and the local school superintendent, it took longer to obtain the approval of the school board. This was accomplished through extended diplomatic discussions that centered around the potential overall cost of the project to the school, the higher utility costs, and the desirability of locating the project in a low-income community. Yet another issue concerned whether the project would cause greater school maintenance efforts and costs. In this regard, EOP contacted the Superintendent of Buildings and Grounds whose engineering skills and expertise helped to resolve this issue.

4. Developing a Work Plan

Once the CAA or CAA/school team has agreed on a feasible project goal, planners should then develop a work plan which establishes an overall plan of activities and schedule of performance.

The first step is to define the project goal in the most specific terms. What results (objectives) does the project anticipate achieving over the duration? These objectives should be described in both qualitative and quantitative terms. For example, if a project's basic goal is to develop among students K-12 an awareness of the benefits to be gained from energy conservation and the use of solar energy applications, then it might establish these anticipated results:

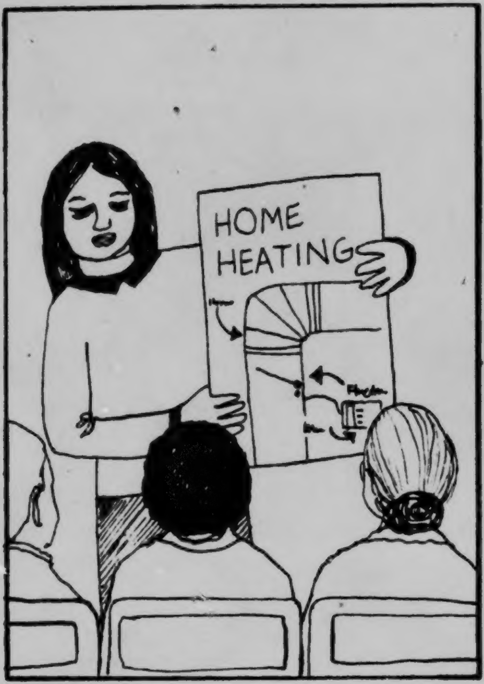


- To have trained 20 eighth-grade students to do home energy audits with their families; or

- To have trained 30 tenth-grade students in the practical skills related to weatherization to enable them to assist in the insulation of two to three homes each in their neighborhoods.

When planners have accomplished this important step, they can then determine and list the project-supporting activities that should lead to the achievement of these results. If a local project anticipates assisting 50 students to inform their parents and other members of the community about the practical benefits of energy conservation and renewable energy sources over a semester, project planners might design the following project-supporting activities:

- Special presentations and/or lectures in local schools and community organizations by low-income youth;



- The involvement of one or more trainees, under the supervision of CAA energy personnel, as outreach people, during school hours or at night and on weekends. This could include talking with families about weatherization programs, working up presentations for local and county fairs, and working with local citizen groups on various issues such as utility rates;

- Conducting site visits to CAA energy projects for other young people and adults;

- Conducting small workshops in which basic demonstration models of energy-conserving devices might be built.

- The creation of a local energy education resource center, where books and other printed material would be available to both students and adults, located at a school, CAA or other convenient site.

After the project planners have outlined the basic goal, anticipated results, and project-supporting activities, they will be ready to begin developing a work plan, which will indicate precisely how the project will carry out these actvities.

In the category of youth awareness activities, project planners might do the following:

- Identify which elementary, secondary, vocational and/or special schools, and in which classes, the CAA will deliver presentations and collaborate in the development of small workshops;

- If the CAA is following Model 2, it should identify at which public events presentations and workshops will be given, and identify the range of topics to be covered in them;

- Develop an educational activity schedule to include start-up time, presentation, basic workshop, and site visit activities, and activities follow-up;

- Describe demonstration models, equipment, tools, and instructional materials necessary for presentations, basic workshops, and site visits.

Similar kinds of activities might be identified in order to describe how the training, community outreach, and career placement tasks will be accomplished, if these are also appropriate areas of activity to be undertaken by a particular project.

5. Recruiting Secondary Participants

a. Introduction

If project planners have worked through the above four steps, they will no doubt have laid a firm groundwork for project development and will also be aware of the gaps that need to be filled. Secondary participants may provide the resources that the CAA and school do not possess. They include, but are not limited to: universities; community or junior colleges; training and technical assistance organizations; and labor unions.

Energy education projects should be encouraged to make the best use of these secondary resource organizations both to increase their ability to achieve objectives and also to broaden the community's problem-solving capability through greater participation. On the other hand, projects should carefully assess both their own needs - training, technical assistance, materials, etc.- and also the potential contribution of secondary participants in order to achieve a reasonable match. In addition, project planners should be prepared to devote extra time and effort to the effective management of such participants in the project work plan. The following questions may help project leaders determine what they might obtain from secondary sources and how that contribution might be effectively managed.

- What resources does the project need which cannot be provided by the CAA and/or the participating school? Consider the areas of materials and equipment, finances, training and technical assistance, and energy- and education-related expertise and information.

- What kinds of organizations might provide the needed resources? There is a broad range of resource organizations including other CAAs; public school, K-12; alternative schools; community and junior colleges; 4-year colleges and universities; energy extension services; consumer education and state energy offices; national associations, environment and energy-related organizations; contractors and/or contractor associations, trade union locals, and manpower/employment offices. Service clubs, such as Lions and Rotary, often donate money to support new community projects and also encourage their member businessmen to donate materials. The local school board, PTA, and teacher's union may also provide various resources.

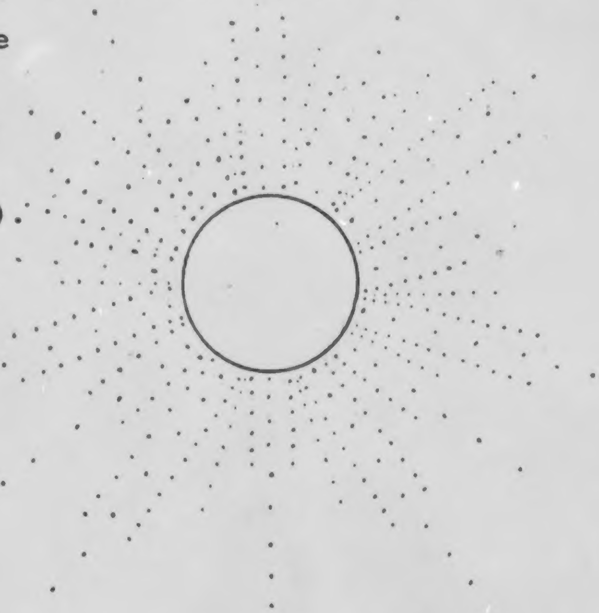
Remember that it is more efficient and productive to obtain and use local resources. Doing so takes less time, builds community relationships, and contributes to community socio-economic development.

- What will the resources cost? Local projects operate against a background of scarce financial resources and cannot be expected to spend liberally to obtain the services and resources of secondary participants. Projects should first seek free or inexpensive resources. Perhaps civic groups may give donations. Or CAAs might consider barter agreements exchanging labor or expertise for needed materials. Shopping around to determine the best price for resources is a good idea that is worth the time. Also, consider the possibility of using recycled materials and/or equipment.

- How will the resources be used in the project? The best way to assure that these resources are efficiently used is to detail their application in the work plan. Resources are used in the project-supporting activities: thus, textbooks, manuals, and hand-outs support instructional tasks; wood and glass support the building of a solar collector; and a solar instructor would be able to train teachers. Each resource can be directly limited to a project-supporting activity and its application can be planned in advance, monitored regularly, and evaluated at the end of the project.

b. The Role of Community and Junior Colleges, 4-Year Colleges and Universities

- Community and Junior Colleges: In general, community and junior colleges currently play a mixed role in energy education efforts nationwide but appear to offer greater support for local energy problem-solving in the near future. On the one hand, many of these institutions are progressive; a recent HUD Solar Status report notes many that do solar vocational training and development (see Chapter VII). On the other hand, an opposing trend emphasizes the development of more traditional academic approaches and subject areas, in an attempt to match the academic status of 4-year colleges. Clearly, this represents a split in direction.



This split is unfortunate given the constituencies for such institutions. Sometimes, these students come from poor or lower-middle-class backgrounds and attend for practical, job, and career development reasons. Community colleges could offer them new opportunities.

The energy vocational training and technical assistance role of community and junior colleges is an expanding one. Many of these institutions, even small ones, have shops equipped with woodworking and other tools as well as shop instruction space that could be used for hands-on workshops. They could give advanced training to older students and provide technical assistance to elementary and secondary school projects. For example, Laney Community College, Oakland, California, acted in a secondary role to help establish a satellite energy learning center at Lakeview Elementary School, Oakland. Community and junior colleges may also advise projects on education and student motivation and could, as a project partner, help to get funding for the project. Already some have developed energy education centers on campus, which pay student volunteers to do outreach activities in local communities and initiate on-site home demonstrations of energy conservation.

In Omaha, the Greater Omaha Community Action agency has engaged in a joint program with Metropolitan Technical Community College to train unemployed young people in solar installation and design. In California, several community colleges, San Jose City College, for example, operate solar training programs leading to an A.A. degree. Though these programs are not directly affiliated with CAA programs, they are targeted at low-income trainees.

Perhaps one way for a CAA program active in energy efforts to approach a community or junior college would be first as a resource for technical support, intending at the same time to discuss joint proposal efforts. The possibilities of funding might be greatly strengthened as a result.

- Colleges and Universities: Such institutions might act as technical assistance resources, providing help in program design and development, faculty development, program evaluation, and so forth.

A recent Solar Energy Research Institute publication, a directory of some 700 post-secondary educational institutions offering solar-related courses, programs, and curricula, is an excellent starting point in any effort to determine if appropriate information resources exist in the area in which a particular project is located. (See Chapter VIII, p. 216 .)

In urban areas, possibilities might exist for contacts with sectarian colleges which stress a sense of social mission; or departments or faculty members in institutions who are interested in working to solve community energy problems. Examples of such activity in fields other than energy are relatively common.

Serving rural, small-town, and suburban areas, land grant universities, through their extension services and agents, have long held a tradition of local involvement. Virginia Polytechnic Institute is currently operating a wide-scope adult energy education program through its extension agents. West Virginia University is helping to train teachers in practical energy issues and techniques through its program.

c. The Role of Unions

Unions could act as secondary resource-providing organizations, potentially offering a variety of educational, training, and technical assistance to CAAs and schools. Certain unions, such as the United Automobile Workers (UAW), the International Association of Machinists and Aerospace Workers (IAM), and the Sheet Metal Workers International Association (SMWIA), engage in considerable solar energy publicity and training activities. In addition, these unions have established and promote well-articulated national energy policies which focus attention on the need for increased energy conservation and concerted development of renewable energy resources.

What are some of the solar activities that unions perform? At present, the IAM's energy involvement is limited to the preparation and dissemination of national energy policy statements that promote the development of renewable energy resources.

The SMWIA provides solar training to workers who already have extensive heating, ventilation, and air-conditioning skills. Through its National Training Fund, Washington, D.C., SMWIA provides training materials, texts, manuals, films, curricula, instructors, and related resources.

The UAW has been very active in the public promotion of the development of renewable energy resources. The UAW Education Department assisted in the organization and promotion of Sun Day, has provided financial support for a variety of public energy awareness activities and has made many presentations on solar energy to community colleges and high schools, employing slide shows, solar exhibits, lectures, and workshops.

At the local level, the CAA/union relationship could be beneficial to both parties in several ways.

- A CAA might be likely to obtain the services of public awareness and community outreach and specialists from unions, such as UAW, which engage in major energy education activities and have experience with demonstrations used in their training programs.

- Retired union members with appropriate experience might work with CAAs and/or schools.

- The CAA might also be able to obtain certain limited training and technical assistance resources, such as solar training materials, films, and tests, from unions such as SMWIA.

- A CAA might pay union technical and training instructors to work in an energy and education program providing their expertise to CAA or school personnel on a consulting basis.

- In some cases, it might be possible to obtain agreement from a union to seriously consider taking semi-skilled graduates of energy and education projects into its apprenticeship program.

An example of such a relationship is to be found in Omaha, Nebraska, where the local CETA program has financed the construction and operation of a union training site in exchange for acceptance of CETA program graduates into union apprenticeship positions or other private sector positions paying an acceptable wage. In this case, the AFL-CIO Local 1140 provides CETA program graduates to other unions under contract, after they have received training in a variety of skills such as pipe-laying, carpentry, and brick-laying. At present, both the CETA program and Local 1140 are working cooperatively with the Greater Omaha Housing Corporation to provide training and on-the-job work experience to CETA workers in low-income residential housing rehabilitation projects and the rehabilitation of a local community activity center.'

- Retired union members with appropriate experience might work with CAAs and/or schools in appropriate energy technology projects.

6. The Last Steps: Monitoring and Evaluation

From the point of view of project design and planning, the successful recruitment of secondary participants in the project and the incorporation of their resources and activities into the work plan signals the stage of actual implementation. Of course, the important work of designing the curriculum and instructional systems must also be accomplished. Chapter III is entirely devoted to helping readers understand the steps, issues, and strategies that are central to these tasks.

If project planners have worked through steps 1 through 7, in all probability, they will have developed a very comprehensive work plan of project-supporting activities which, if properly carried out, should bring the project close to achieving its basic goal within the established duration of the project. Once the project is under way, the real challenge of project management begins. Many problems may face project managers. For example, planners usually underestimate the time necessary to accomplish results. They cannot always foresee all the consequences of certain actions. Anticipated resources may arrive later or not at all in some cases. Funding may be inadequate. Project staffers may withdraw for personal reasons. Administrative forces may constrain the project.

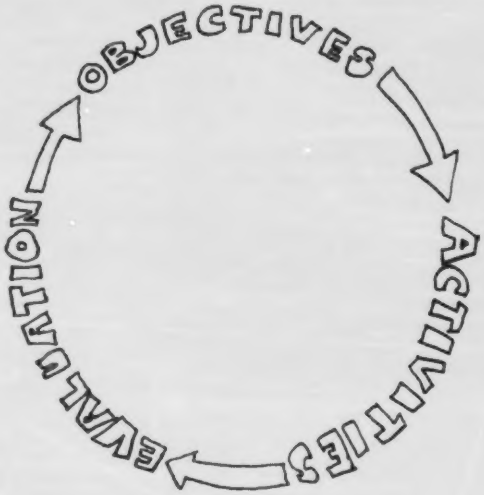
Although problems cannot always be solved, they certainly can be minimized to the point where they no longer threaten the successful outcome of the project. Understanding the goals of the program, developing strategies to overcome the various issues and problem areas, and comprehensive design and planning are the initial steps to take in minimizing problems. Regular and comprehensive monitoring of the project is the key to assessing the project's progress, determining the existence of problems as early as possible, studying problem situations, establishing their causes, developing alternative solutions, selecting an appropriate solution, and carrying out its related activities. Careful monitoring, in order to discover problems early, gives project managers increased flexibility to deal with situations that may severely hamper the achievement of objectives.

How should an effective monitoring of the project be carried out? For small-scale projects involving only a few staffers working at introductory-level energy-related teaching, it will be easy to monitor the progress of project-supporting activities. For larger projects with more sophisticated work plans, it will be necessary to focus attention on the monitoring function. The best way to ensure monitoring is the assignment of that responsibility to a particular project staffer, who, in turn, would work with other staffers who are directly concerned with doing the activities that need to be monitored.

What should be monitored? If the project director has organized an efficient work plan, that plan will detail the project-supporting activities leading to achievement of the anticipated results and will translate the work plan into a work schedule, with the establishment of interim objectives (milestones) over the duration of the project. Monitoring can verify the achievement of these milestones.

If a milestone is not achieved, then the monitoring should attempt to discover why the scheduled objective was not met. This would involve assessing: (1) the project-supporting activities for efficiency and effectiveness; and (2) the quantity and quality of the resources that are used in these activities. In addition, monitoring should take into account the effects of unforeseen circumstances.

Evaluation is the last important step in the entire project management process. Basically similar to the monitoring function, evaluation (assessment) occurs at the end of the project and asks the question: did the project achieve its basic goal? The purpose of evaluation is to develop a comprehensive understanding of the project so that its positive aspects may be repeated and its negative ones avoided in future efforts. A secondary purpose is to disseminate the evaluation results to others so that they too can benefit from this understanding.



Who does the evaluation? A project may perform its own evaluation, receive evaluation assistance from an independent source, contract out the performance of an evaluation study, or combine all these approaches. In order to gain useful experience and disseminate information about its project to others, it is recommended that projects do their own evaluations, whether formal or informal. However, project evaluations should not be so extensive in nature and scope that they drain scarce resources that would better support another project activity.

Within the project, the team could designate one individual responsible for completing the evaluation. If the project personnel know in the early design phase that the project will involve both monitoring and evaluation, the responsible person should incorporate these activities into the work plan, thus establishing a firm foundation for these assessment activities.

B. RECAP

STEPS IN PROJECT DEVELOPMENT

- Deciding to participate
- Establishing feasible project goals
- Obtaining school participation
- Developing a work plan
- Recruiting secondary participants
- Monitoring and evaluation

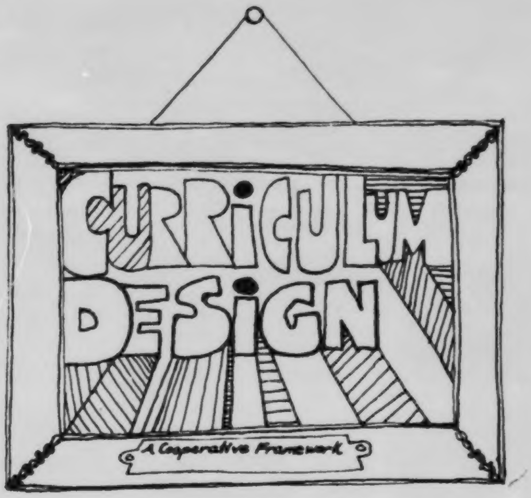
CHAPTER III

CURRICULUM DEVELOPMENT FOR ENERGY EDUCATION

A. INTRODUCTION

The purpose of this chapter is to assist new and existing energy education projects to develop appropriate curricula and effective teaching methods. It is particularly oriented to CAAs who, new to the field of education, may intend to carry out energy education projects independently. This chapter describes a simple curriculum model, including goals, instruction, and evaluation, and also presents guidelines for curriculum development.

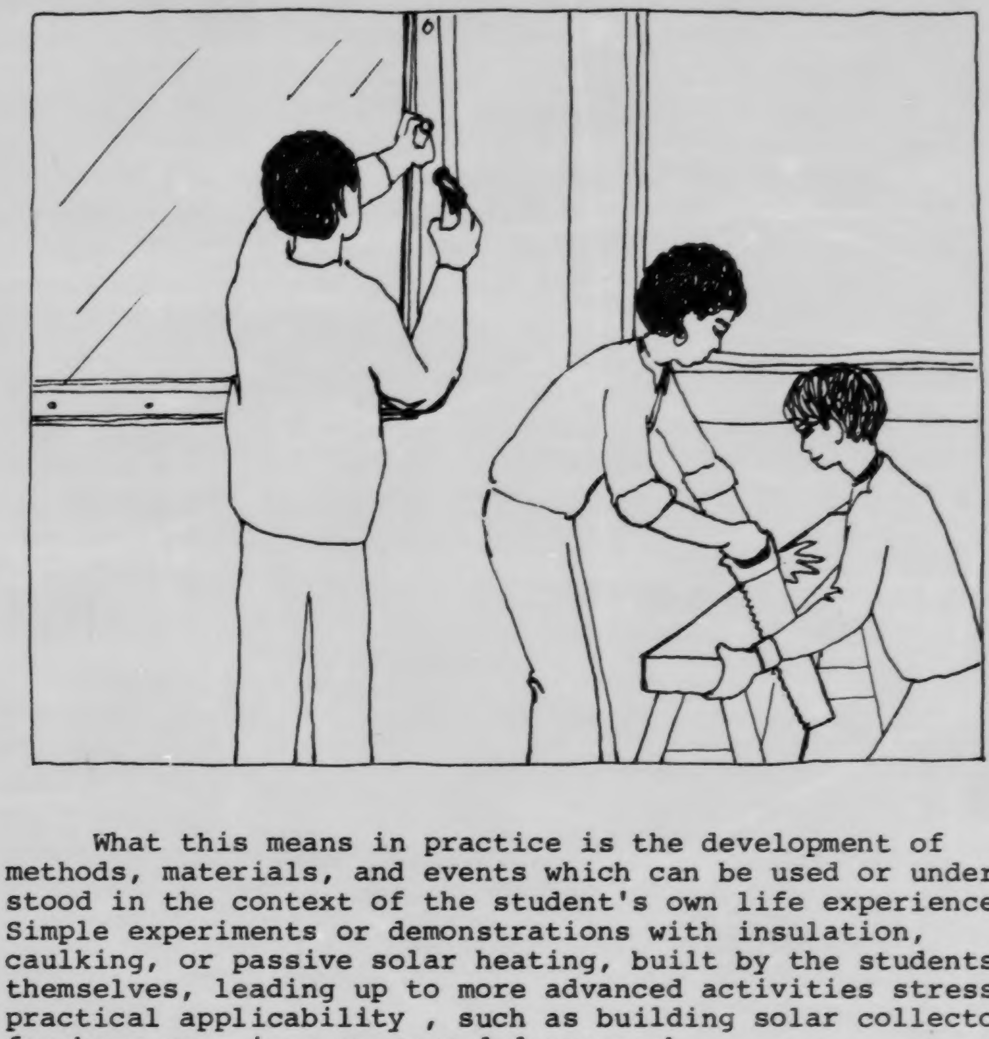
Early in the project, educational planners will need to focus their attention on the subject of curriculum design. Most simply stated, a curriculum is the set of courses offered in a particular topic. It is the content or body of information that is to be taught. A broader definition, however, may be more appropriate to the kinds of energy education discussed in this manual, in which CAAs and schools cooperate to educate students, their families, and communities in energy matters. Thus, an energy education curriculum could be defined as all of the energy-related learning experiences that students, their families, and other community residents participate in to better prepare themselves to understand and solve their energy problems.



It will be useful to remember that the nature and scope of the curriculum will vary according to the program model that a particular CAA follows and also the relative emphasis that a CAA might place on in-class versus community outreach energy education activities.

B. THE PRACTICALITY OF ENERGY EDUCATION CURRICULA

The immediate problem with many energy education curriculum efforts is one of impracticality. Much of the existing curricula in this subject is simply not appropriate to the practical interests of many students, including the majority of those from low-income communities. These curricula are too often couched in contexts that are too academic in nature and too global in scope. More recently, educators have begun to realize the need to develop approaches to energy curricula which are appropriate to both the needs and interests of project participants, i.e., schools, families, and the community.

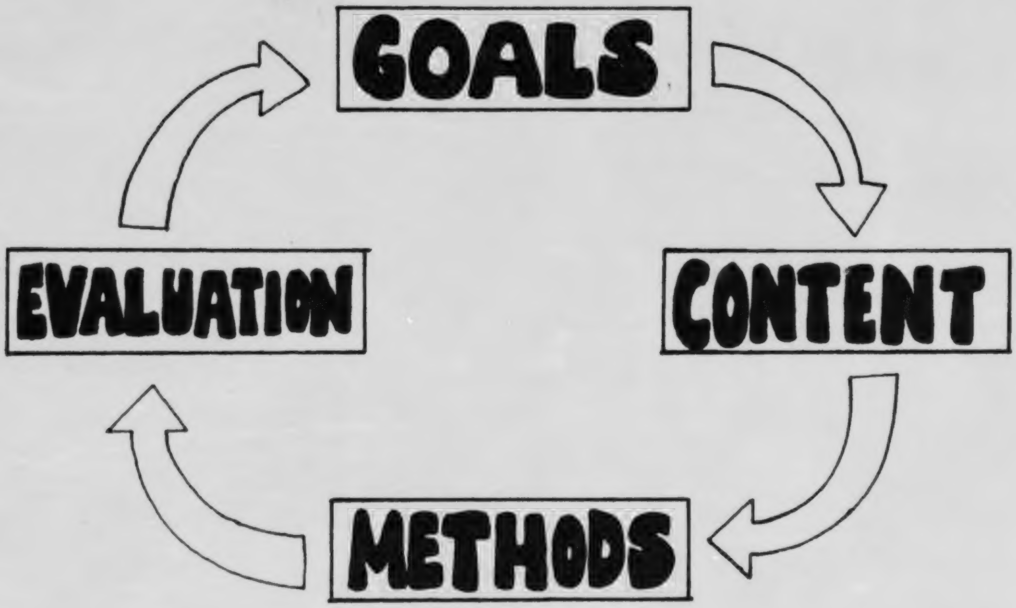


What this means in practice is the development of methods, materials, and events which can be used or understood in the context of the student's own life experience. Simple experiments or demonstrations with insulation, caulking, or passive solar heating, built by the students themselves, leading up to more advanced activities stressing practical applicability , such as building solar collectors for home use, is a recommended approach.

This approach is especially appropriate, given the possible reluctance of administrators to introduce extensive new curricula into their schools. The Staples school system, Staples, Minnesota, points out that many educators feel that they are already overloaded with new curricula and can barely keep up with what they already have to do. Given declining budgets, they also usually cannot afford to institute totally new curricula, but prefer to integrate on a selective basis new content and methods into existing curricula. CAAs may be well suited to assist in the development of practical and inexpensive energy education curricula through their familiarity with energy programming in such areas as weatherization, energy crisis intervention, and renewable energy applications and can also provide personnel and technical assistance to schools.

C. A SIMPLE CURRICULUM MODEL

At this point it may be useful to present a simple curriculum model, the basic elements of which are (1) goals, (2) content, (3) methods, and (4) evaluation.*



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*This curriculum model is adapted from John R. Verduin, Jr., Harry G. Miller, and Charles E. Greer, Adults Teaching Adults, Learning Concepts, Austin, Texas, 1977, pp. 21-33.

1. Goals

Curriculum developers are initially concerned with goals and must thus determine the body of knowledge and/or skills (content) that students and, secondarily, their families and selected community groups, should learn within a given time period (the project duration). Educational planners and curriculum developers should ask themselves the question: what energy-related knowledge is most worth learning? The answer to that question should be derived in large part from the nature of the project goal and objectives that project planners/community residents have previously formulated (see p. 22).

Curriculum goals may be stated at three levels for three corresponding time periods: general (long term), intermediate (middle term), and specific (short term).

An example of a general goal for a 2-year vocational education program in energy might be to have the majority of graduates accepted into union apprenticeship programs. An intermediate goal focuses on individual courses over a shorter time period, such as a year's course of instruction, a semester, or a term. At this level, a curriculum goal might state that a high school student working in an energy education project will learn enough to construct five different kinds of small solar devices in one semester. Specific curriculum goals focus in a precise way on short-term learning. For example, an instructor may establish the goal that students will be capable of reading and understanding insolation charts and applying that knowledge to site work after 1 week of instruction.

2. Content

Having established the general, intermediate, and specific learning goals, educational planners must assess their students' knowledge and determine what they should learn in order to achieve these goals. They must formulate the content of the curriculum - the energy-related information, knowledge, and skills that are to be learned by students, and when appropriate to the particular CAA's orientation, students' families and community groups. This content includes in part the individual activities that are described in Chapter IV, Step #4 and in Chapter V.

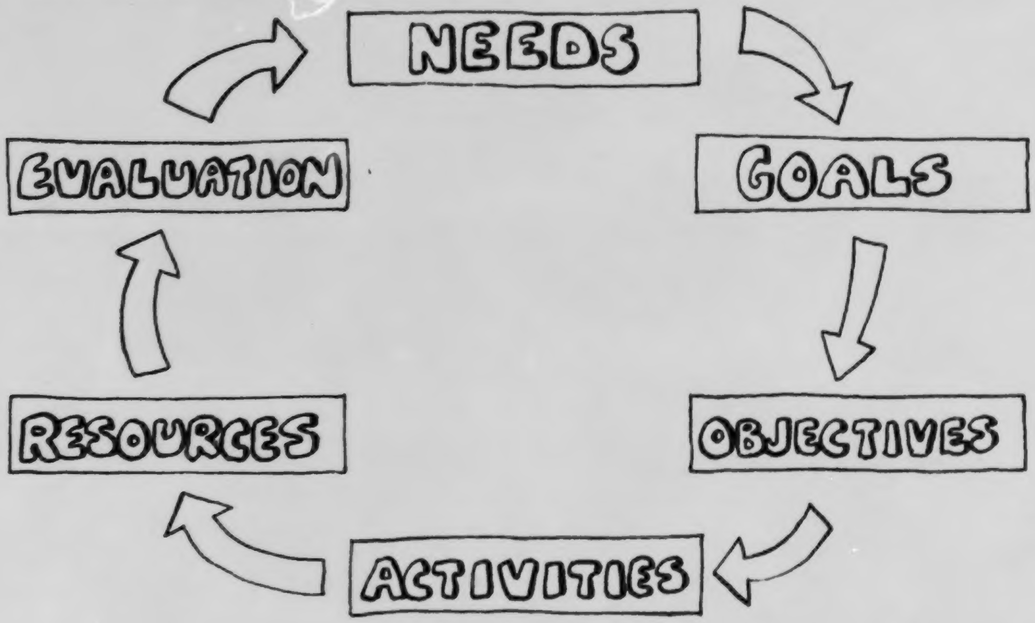
3. Methods

The development of instructional methods is the next basic component in the curriculum model. If the goals and related content are the "what" of this model, then the instructional methods are its "how," the ways in which the materials are to be communicated. From another perspective, it is the interaction among teachers, students, and content working to increase the students' knowledge and broaden their understanding and improve their skill competence.

4. Evaluation

Evaluation, which is the final element in this curriculum model, attempts to measure student learning. Evaluation processes can be established to measure progress toward learning goals at the general, intermediate, and specific levels. Evaluation instruments may take the form of external tests that are developed outside the project, e.g., by a local university, or they may be developed inside the project, by its instructors or other project participants.

All of these curriculum development elements are discussed in detail below.



D. CURRICULUM DEVELOPMENT GUIDELINES

Here are the basic steps involved in curriculum development, with appropriate strategies to assist education planners to overcome potential problems and achieve their objectives:

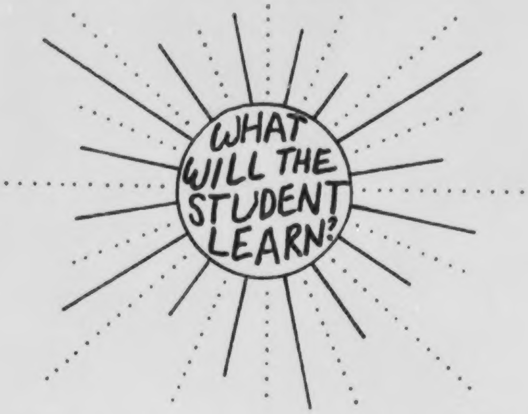
- Establish a cooperative setting for curriculum design;
- Define the students' learning goals;
- Assess the students' knowledge;
- Assess the students' motivation to learn;
- Define and organize the content;
- Select materials;
- Design and/or select appropriate strategies;
- Assess the students' learning.

1. Establish a Cooperative Framework for Curriculum Design

When a CAA and a school are co-participants in an energy education project they should design and develop the curriculum together. Most likely this will take place naturally as a CAA representative would presumably contact a teacher from a department that would have a major interest in the project and curriculum design to meet its objectives. This relationship between the CAA educational planner and school teachers would develop into the core curriculum design team. The curriculum should reflect the intent, capabilities, resources, and interests of the institution(s) where the project will take place, and of the teachers who will implement the curriculum. Teachers should play a significant role in its development or they may have difficulty teaching due to their lack of understanding and/or involvement.

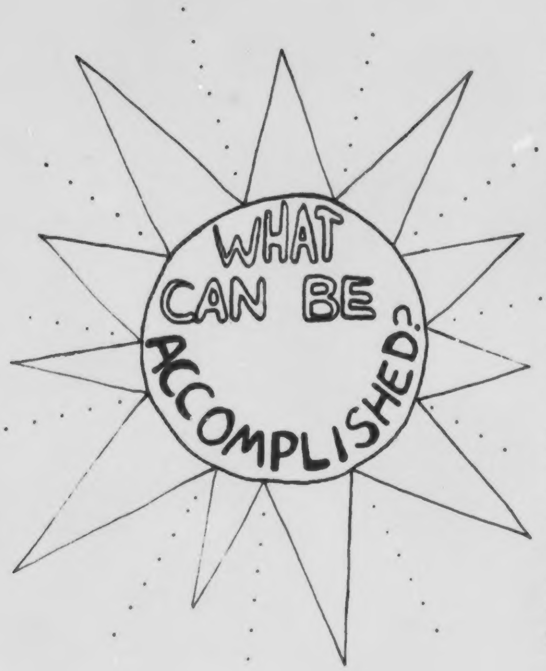
2. Define the Students' Learning Goals

A CAA educational planner or a CAA/school curriculum design team should pay particular attention to the important activity of designing curriculum goals. The curriculum goal must answer the question: what does the project want the student to learn and/or be able to do? For example, what would students need to know in order to: (1) build a solar cooker, (2) build a solar greenhouse, (3) understand the basic principles of energy conservation, (4) do a home energy audit; (5) assist their families to insulate their homes? The detailed analysis of these questions would provide much useful information for curriculum development.


WHAT WILL THE STUDENT LEARN?

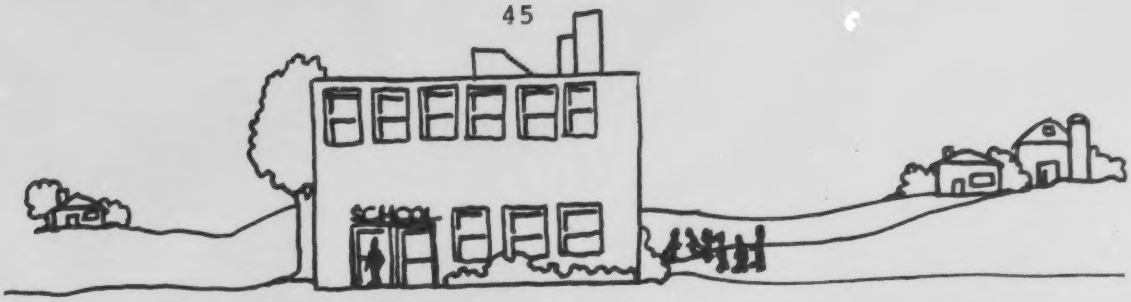
Educational planners should also address several goal-related questions early in the planning phase.

- Curriculum scope: How comprehensive a view of solar energy education need the curriculum offer? Is it necessary to educate students in both energy conservation and solar applications in addition to presenting local, national, and international aspects of energy supply and demand? Curriculum planners should pay considerable attention to the scope of learning activities that the project will offer to students. The scope should not be so broad that it cannot be carried out effectively. Similarly, it may not be necessary to focus equally on energy conservation and renewable energy development and applications.



It is suggested that projects without significant experience in energy education take a conservative approach to curriculum goals and scope. Do not attempt too much. Remember that there is usually a tendency to overestimate project capabilities and resources. It would be a better idea to move into this new area of activity gradually and only increase the scope of educational activities when experience has proved the feasibility of doing so.

- Organizational capability and resources: Curriculum goal-setting should not be accomplished without a careful assessment of organizational capability and resources. Both CAAs working independently and CAA/school partnerships need to assess their present capability to undertake energy education projects. Based on their recent experiences in energy, educational, and community development programming, what could CAAs and/or schools reasonably accomplish without straining their capabilities?



WHAT RESOURCES ARE AVAILABLE?

Similarly, having tentatively established a project goal and specific objectives, educational planners should then determine the resources that are needed, their costs, and their availability. This is a useful planning step even for the smallest projects, and one which indicates whether there are sufficient resources available to do the specific project. Try to be resourceful and inventive as you do this planning!

Projects can research this important question by developing a list of project-supporting activities that are specifically oriented to the curriculum goals and listing the resources that are required for each. For example, a project that intends to educate students to build solar greenhouses will need materials, skilled teachers from the school and/or other instructors, sufficient space in the school or at another facility, and small amounts of money to cover these needs and other miscellaneous requirements. However, depending on the goals of the project and the scope of the curriculum, the amount of required resources could be considerable.

- Time: What is the duration of the project? How much time will CAA instructors and/or school teachers have to work on a particular energy education project? How much learning time is available to students, given class, homework, and outside work responsibilities? How much learning can students, their families, and selected community groups be expected to accomplish?

HOW MUCH TIME?

- Instructors/teachers: Energy education project planners also need to assess the knowledge and expertise of CAA instructors and school teachers. Are they familiar enough with the material to be taught, or will they themselves need preliminary training? If so, what types of training for what period of time? Where can this training be obtained, and at what cost? Judged against the constraints, is the training of teachers a feasible activity? If it is not, planners may have to scale down and/or modify project objectives to accomodate what is realistic.

- In-service teacher training: This highlights the issue of in-service teacher training. Energy education projects that need in-service teacher training should select a particular program or institution carefully, for in-service teacher training programs in the energy field cover a wide range of subjects and teaching methodologies. Not all of these may be most appropriate to the more practically oriented needs of energy education projects in which instructors need to be involved in building and installing energy conservation and alternate energy hardware.

WHAT DO YOU SEE LOCALLY?

Existing faculty development programs in energy can provide an introduction to energy as a broad issue. Programs should provide a direct link between what is perceived as the "energy crisis" and the local situation, and describe what local energy-related conditions are.

Appropriate programs will include more practical activities such as those described in Chapter V. They could establish jointly funded faculty development programs to establish summer workshops for teachers in low-income areas, which might teach them basic energy skills, engage them in more advanced energy training, get ideas for curriculum approaches from them, and involve them in joint conferences with CAA employees. Resources for teachers are described in Chapter VIII.

3. Assess the Students' Knowledge

As the project begins, the instructor, in order to establish realistic learning goals for the project's duration may want to learn what the students already know about energy. Students' knowledge should be assessed from the perspective of the physical sciences. Their mathematical knowledge should be determined, and basic understanding of energy conservation and renewable resource development and applications explored. While some students will know more than others, the instructor will surely be able to determine a general level of energy-related knowledge and can begin to pinpoint the strengths and weaknesses of the students. Instructors could assess their students' knowledge by using some of the level I energy learning exercises which are described in Chapter IV.

4. Assess the Students' Motivation to Learn

At the same time, the energy education project instructor will also want to determine the students' interest in the project. Energy education projects have reported that student motivation is one of the basic problems they encounter.

Education is frequently not directly related to students' interests nor to their day-to-day experience in their communities. What is true of general education may also be applied to energy education programs. It is not difficult to understand how, for example, those programs dealing with global energy issues are not particularly relevant to students whose knowledge of geography and world politics may be sketchy at best. This is not to say that awareness of the world energy context is not important, but that it must be communicated in an appropriate way to the students. For example, if a teacher uses a case study approach centering around the practical problem of paying increasing utility bills, the very immediacy of that local problem could serve as a stimulus to the student to better understand the internationally-based causes for high oil prices and utility bills. Inappropriate curricula and teaching that leave students

passive in the classroom, which are difficult to understand, or which lead to no relevant goals in the students' estimation, serve to reinforce a negative self-perception on the part of low-income students. Attacking this motivation problem involves changing the negative self-perception to a positive one.

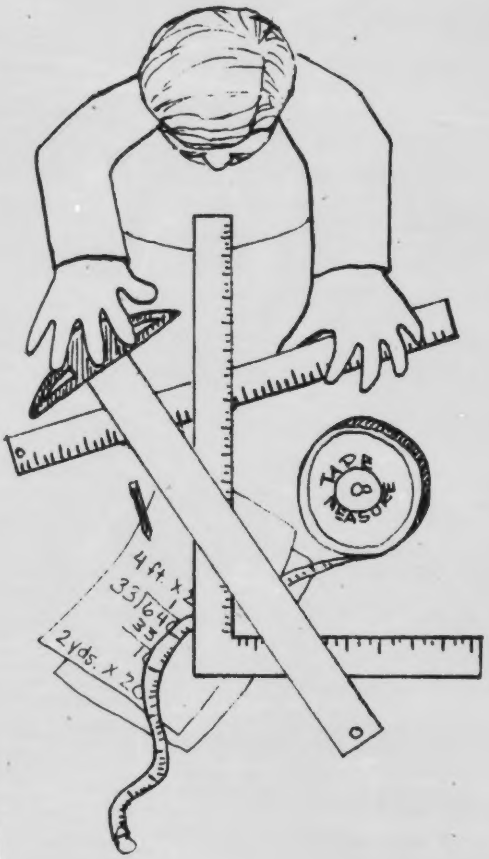
The students' interest could be developed through a project which, drawing on multi-disciplinary approaches, is at once personal, practical, and purposeful. Making the project a personal experience involves structuring it around the perceptions and experience of the student. Relating energy to the individual, his/her home and community, through the home utility bill case study approach, for example, is one way to do that. Secondly, educational planners and instructors can emphasize the development of a personal yet authoritative teacher-student relationship.

Energy workers of the Cranston CAA, Cranston, Rhode Island, believe that the close relationship with an authority figure provides the student with attention from a person who is respected and thereby enhances the student's self-respect. This personal approach encourages the student to have a positive self-image, which continuing activity and the completion of projects serve to reinforce. Continued reinforcement motivates the student.

Making the program practical means having the student build things, such as the devices suggested in the next chapter, that can be completed and used. For example, Greater Omaha Community Action, Omaha, Nebraska, worked with the Metropolitan Technical Community College to train high school students and other youth to do solar installations. The ACTION CAP, Evansville, Indiana, is training low-income school youth to build solar window-box collectors. Such practical activities give learners a sense of control over their own lives, the knowledge that they can produce something useful, with the resulting feeling that they are valuable because they can produce objects of value. The more practical the projects a student completes, the stronger the student's positive feelings should become.

Closely related to this aspect of practicality is the purposefulness of the students' activity. Not only is this work useful to the students' own lives, potentially conferring the possibility of career development, but it is also useful to their families, friends, neighbors, and community.

Both CAAs and schools should therefore strongly consider the active involvement of students in the projects. Such involvement may have a number of dimensions, including design and re-design of activities, construction, model building, demonstrations, and performing home energy audits with the participation of their families. It could also include participating in and organizing various community outreach and public information activities, including poster contests and school, street, and community fairs.



Effective teaching by instructors in the project will also serve to motivate students. Teachers need to demonstrate their practical command over the energy-related material to be taught. A teacher who is not qualified to carry out the various aspects of the project, whether academic, manual, or a combination of the two, will soon find him-/herself at a decided disadvantage with the students, who are usually quick to note such deficiencies. Instructors also need to create and promote an atmosphere of support for students. While this not the only or the most important role for the teacher, it is nevertheless an essential one for projects whose basic strategy it is to involve the students.

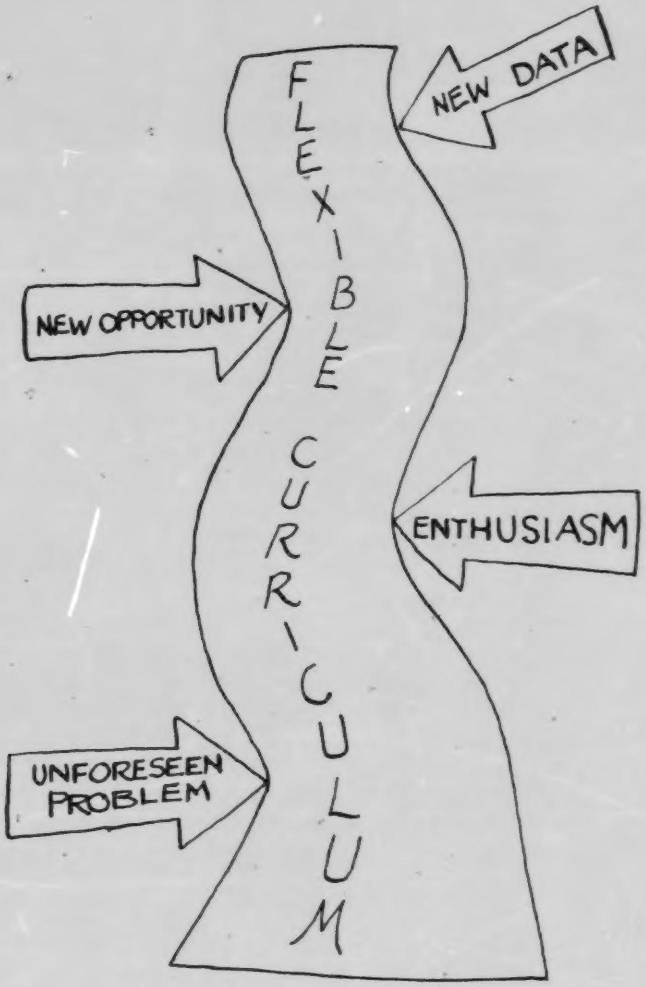
A good example of this support role was reported by the Portland Area Regional Vocational Center, Portland, Maine. When, in a project to teach the principles and techniques of energy conservation, the students began to balk at studying some of the math necessary for an understanding of energy conservation applications, the instructor slowed down the pace of instruction and began to work individually with the slowest students until the entire class understood the essentials.

5. Define and Organize the Content

The instructor is now ready to define and organize the specific content of the course of instruction. These specifics should follow logically from the curriculum goal, which, at the specific level, will establish what the students should know and/or do by a certain date, while the content determines the bulk of the information they need to assimilate in order to reach that goal. Chapter V presents such information for the construction and/or performance of many energy-related activities, including kilowatt-hour charting, a bio-gas generator, demonstration windmills, a solar cooker, a solar greenhouse, poster contests, and local energy fairs. As stated before, selection of these or any other activities should be based on the extent to which the particular activity will contribute to achieving the educational goal. For example, if the educational goal is to prepare students to make community presentations on simple energy conservation strategies and techniques, then the formulation of content would most appropriately include charting electrical kilowatt hour conservation (#11, Chapter V, p.125). Or if the project goal is to increase students' awareness of renewable energy alternatives, the educational goal might be to develop their understanding about the feasibility of residential wind devices. The content would thus center around what the students would need to learn to (1) increase home electric consumption and (2) determine how much electricity a particular wind device would generate. Activities No. 10, a small wind generator (p.121), and No. 11, charting electrical kilowatt hour consumption (p.125), are key projects to assist students to achieve this learning goal.

For example, an instructor might establish an intermediate-level curriculum goal to prepare sixth-grade students to design and construct a model solar-heated greenhouse (2 ft x 3 ft x 1 ft) over a 4-month period. In order to achieve this goal, the students would study and explore the following course content:

- Principles of heat loss and gain;
- Heat storage systems;
- Principles of ventilation;
- Greenhouse insulation;
- Physical design principles;
- Elementary carpentry skills;
- Qualities of materials.

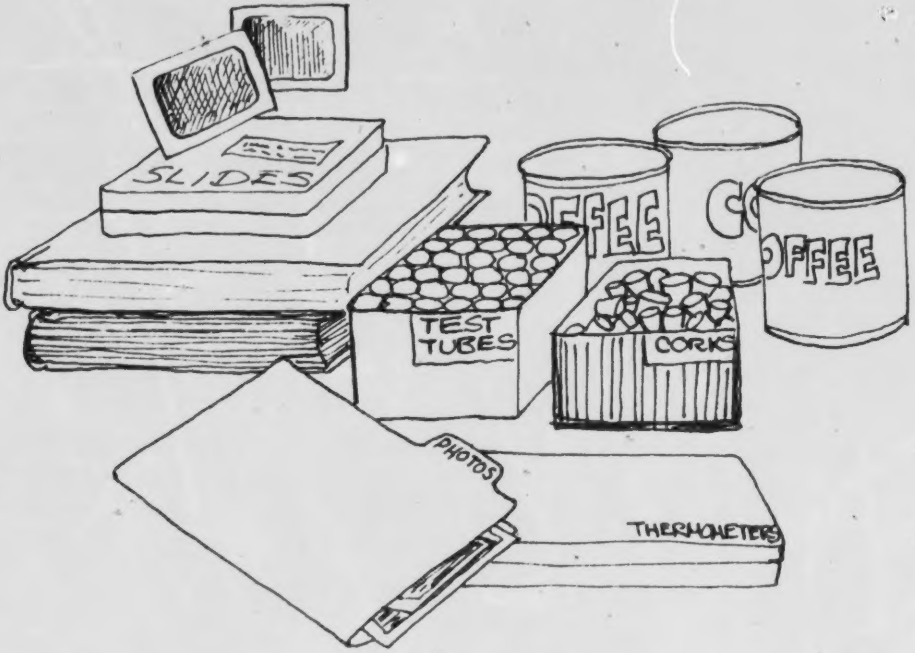


It might be useful at this point to state that it is not effective to take an overly strict approach to the implementation of the curriculum. Design a certain amount of flexibility into the curriculum, with regard to both goals and content. Students and teachers can then take advantage of unanticipated opportunities that might enhance the project and can also improvise and re-design aspects of the project that may need modification. Some projects, including the Portland Area Regional Vocational Center, Portland, Maine project, have reported that the teaching of math for energy conservation and renewable energy hands-on activities has required much more time and effort than originally projected. Central Nebraska Community Services, Inc., Loop City, Nebraska, indicated that students became so enthusiastic over the two designs of passive solar collectors presented to them that they proceeded to produce four more designs. There are many other situations in which too strict an adherence to the original curriculum would have more negative than positive effects on the outcome of some aspect of the project. It is probably best to design a moderately flexible curriculum and then implement it on the basis of your careful monitoring of the project's progress.

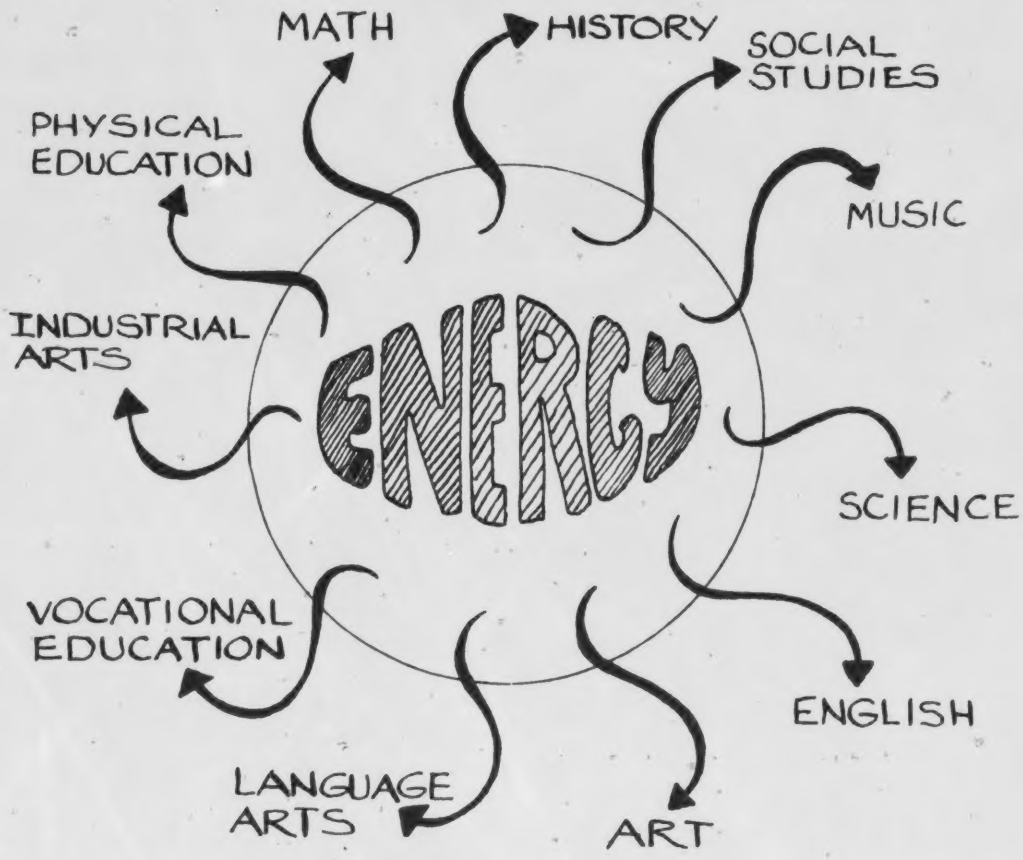
6. Select Materials

Energy education project instructors need to select the materials - texts, audio-visuals, demonstration models - that will best illustrate the content that has been defined and organized in the preceding step. The materials will thus reflect that step and directly assist the students to achieve their educational goals.

For example, a sixth-grade class might undertake to test insulative materials. A specific goal might be formulated as follows: students will develop an elementary understanding of insulation and thermal conductivity by testing insulative materials over a 2-day period. The materials needed for this include test tubes of equal size; corks or rubber stoppers for the test tubes; cans (soup or coffee) of equal size; insulative and non-insulative materials, including fiberglass insulation, paper, styrofoam chips, and sand; and thermometers. Remember that it is desirable to use re-cycled materials, such as lumber and glass, to the maximum extent possible, for both resource conservation and money savings. The materials required for many practical energy-related learning activities are discussed in Chapter V.



The materials that instructors choose will most likely be multi-disciplinary in nature, derived from the many ways in which energy influences our lives, as reflected in the disciplines of natural science, mathematics, social science, art, and philosophy. The multi-disciplinary approach is useful because it allows the school to do energy studies and activities within the general confines of the established curriculum without imposing a significant burden on the teachers. This approach encourages teachers to both incorporate energy-related information into their own classroom activities and to contribute their specialized knowledge and skills to potentially all school energy-related events. For example, an art teacher would be instrumental in the development of a school energy poster contest, or a history teacher might cover the historical aspects of energy use. Schools/CAAs decide the nature of this multi-disciplinary effort themselves, based on a common discussion of possible projects, available personnel, and appropriate resources. See Chapter VIII for a list of available multi-disciplinary energy education curricula.



7. Design and/or Select Appropriate Strategies

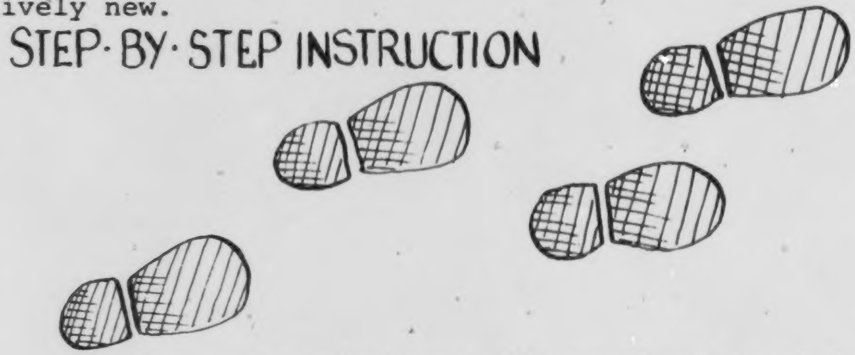
The development of appropriate and effective strategies is one of the most important activities for project planners and educators. Here are some of the methods that energy education projects report having employed successfully in their communities.

- Do hands-on activities: This is a highly recommended approach which motivates students and assists them to understand the course content. Many projects employ this approach. For example, the James Buchanan High School, Mercersburg, Pennsylvania, organized a Practical Technology Club in which students learn to build solar food driers, ovens, and window units. At the Upland Hills Farm School, Oxford, Michigan, students make demonstration models of appropriate technology devices.

The rationale for the manual activities strategy in the classroom is that it motivates the students and allows them to work cooperatively in team projects. It does this by encouraging the more skilled to teach and assist the less skilled, permitting students to take a more active and independent role in their own learning activity, and promoting a stronger self-image through the completion of short-term, tangible projects. Outside the classroom, the active involvement of the students in practical, energy-related work/learning exercises and activities might take the form of energy poster contests, demonstrations throughout the community to PTAs, other schools, and interested civic groups and at local, county, and state fairs.

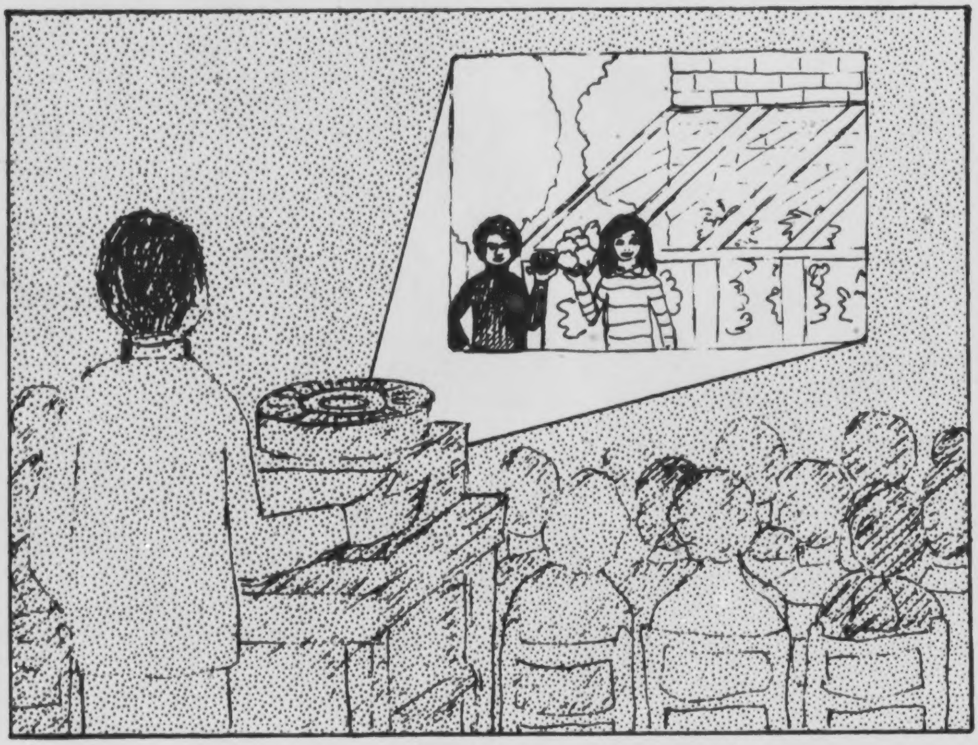
What project resources might be necessary to successfully involve students in these practical activities? First, the project needs an instructor who can perform the specific manual and mechanical activities without hesitation and who also knows the scientific principles that underlie those activities. If the intended teachers do not have this background, it might be useful for the project to arrange for suitable training. If such training is not feasible, projects might consider implementing a buddy system, whereby a skilled practitioner is available to backstop a more inexperienced instructor when the latter needs assistance. In addition, the participation of local people who have done projects on their own as backup instructors and/or guest speakers is also desirable. They lend credibility to the new project because they have already built something.

In addition, the instructor should be capable of breaking down the activity into its component steps and logically presenting these to the students. This ability may require some practice on the part of teachers for whom this type of instruction is relatively new.



Second, such activities will require materials that are durable enough to allow many students to repeat the exercises. Projects should obtain sufficient materials to permit a number of students to perform specified activities in order to develop a productive momentum in the class.

Third, in order to improve the effectiveness of instruction, it might be a good idea to introduce specific manual activities with an audio-visual presentation that shows others working on various stages of a specific project, including views of the finished product. For example, slides or films of the process of building a solar greenhouse usually go far toward motivating students to attempt the same activity in their own energy education projects. The Southeast North Dakota CAA, Fargo, North Dakota, features a traveling slide show to communicate energy-related information to diverse audiences.



- Conduct workshops: CAAs who contemplate working alone in energy education projects often conduct workshops in schools. The Havre, Montana, CAA cooperates with schools to give workshops in elementary schools which usually center around such simple demonstration projects as a styrofoam aluminum solar oven in which pupils bake cookies. The El Dorado Community Action Council, Placerville, California, presents workshops in third- and fourth-grade elementary schools based on the "Energy Ant" filmstrips, discussing the film with the children and giving them "Energy Ant" coloring books. The Northwest Montana Human Resources Council, Kalispel, Montana, has developed and offered to high school shop and science classes a 3-1/2-hour workshop program which deals with weatherization, wood heat, and a wide range of solar collectors.

The workshop approach has numerous advantages. CAAs, drawing on their previous energy-related experiences in weatherization, solarization, and community outreach, could design workshops to be presented in classes from K-12. Once a CAA has given a small number of such workshops, it will begin to develop a basic workshop model which will be applicable to a broad range of target audiences and within the energy field.

Workshops, which take relatively less time to prepare than classroom curricula and lesson plans, often have more of an impact than the more routine format of classroom instruction. The Havre CAA reports that small elementary schools in its region are eager to hold energy workshops for their students. Several have invited the CAA to make return visits. The Economic Opportunity Commission of Nassau County, New York, reports that its high school energy workshops in 11 school districts have been successful among students and teachers alike. This success is due in part to the nature of the presentation, which discusses energy from the point of view of the students' everyday lives. It also includes the showing of a film or slides and incorporates a model solar energy building and related discussion. It finally concludes with a talk on job and career possibilities in the energy field, followed by a question-and-answer session.

- Make site visits: For low-income urban and rural students, site visits represent opportunities to increase their knowledge of energy-related matters, the energy options available locally and regionally, and the energy problems of the communities in which they live. Energy education projects indicate that site visits are well appreciated by students. In general, there is a broad range of potential site visits for students to make, including weatherization work sites, solarization projects such as the Bronx Frontier Windmill site in New York City, any of the Solar Utilization, Economic Development and Employment (SUEDE) sites (write CSA, see p. 174), new and old solar homes, appropriate technology businesses, renewable energy fairs, utilities, public education centers, unions involved in energy education or energy-related work, factories, nuclear utility plants, and government agencies dealing with energy issues.

In Phoenix, Arizona, high school students visit the energy conservation house of People United for Self-Help and participate in solar demonstrations and workshops. In a project operated by Bay Area Engineering Societies' Committee for Manpower Training, Inc., Oakland, California, students from the Lakeview Elementary school visited a hydroelectric dam, a coal mine, a windmill site, a steam electric generation power plant, and the Farallones House, an urban solar energy and energy conservation site, all within the area. In Wilkesboro, North Carolina, students are taken on tours through the Blue Ridge Opportunity Commission's solar home.

Students will learn more from these site visits if the teacher makes sure that the site visit takes place within an overall learning context. The students should have some general understanding of the purpose of the site visit and its relationship to the energy material being studied in class. Teachers can convey this understanding to students through preparatory class discussions in advance of the site visit. Similarly, a post-site visit activity such as a class discussion, a small group debate, or individually written reports will help students to reinforce the impressions gained at the site visit, gain answers to new questions, and put the experience into perspective.

Broadly considered, site visits offer many opportunities to energy education projects. In terms of numbers of students participating, an entire class, groups of students, or individual students may make site visits. One objective of a site visit might be to interview energy-related workers in the community to learn more about specific energy problems. More advanced students could make energy presentations to various citizens' groups. Such visits could lead to the development of individual or group work/study projects. The Southeast North Dakota CAA, Fargo, North Dakota, employs CETAs to teach energy conservation to both elementary and adult classes. Students from the Somersworth Regional High School, Somersworth, New Hampshire, worked on the development of passive solar applications in the local firehouse and intend to retrofit municipal buildings with solar hot water heaters. In Portland, Maine, high schools send their vocational students for energy-related training to the Portland Area Regional Center.

- Use audio-visual materials: The use of audio-visual materials, to accompany lectures and as an integral part of workshops, is also an effective method of communicating energy information to students. Many energy education projects show slides and films as part of their presentations to schools and communities. They also make use of other types of audio-visual materials, including working demonstration models of solar devices. In fact, some projects have their students actually build models for use in family and community outreach energy education activities.

Where might such audio-visuals be obtained? Many CAAs and schools have begun to document their activities on film both as an internal record and also to disseminate, at the cost of reproduction and mailing, to other interested groups and projects. Local libraries are a particularly good source of filmstrips for classroom use. The educational and energy sections of such agencies as the Department of Energy, the Community Services Administration, and the Energy Education Center of the U.S. Office of Education may provide information on such possibilities (see Chapter VIII). An excellent starting point is the audio-visual section of the Solar Energy Education Bibliography prepared by the Center for Renewable Resources. See also REEL Change: A Guide to Films on Appropriate Technology (Soft-Aware, Inc., Hadley, Massachusetts) and the New York State Alliance to Save Energy, Inc.'s Energy on Film, which lists energy-related films for free, rental, or purchase. (See Resources, Chapter VIII.)

8. Assess the Students' Learning

Assessing the students' learning is the last major step to be carried out by energy education projects. This assessment activity, which is also called evaluation, takes place both during and at the end of the project, and generally consists of the design, writing, and administering of a variety of measures to assess the learning of energy-related knowledge, skills, and attitudes.

Evaluation serves a number of useful purposes. It indicates the quantity and quality of the students' learning and provides a firm rationale for changes in project objectives and/or instructional activities. It allows the students to record their own progress, thereby increasing their motivation, providing a means of improving future efforts, and documenting the teaching/learning experience so that other projects may benefit from it.

CAA and school curriculum planners/instructors should begin to think about evaluation as early as the design phase of the project. What, when, and how to assess the students' learning are perhaps the major questions for educators to consider. Given the great variety of energy education project objectives, approaches, and activities, it is not possible here to make more than a few suggestions in response to the following questions.

- What is to be assessed? Assessment should be primarily concerned with the degree to which students are achieving the intermediate (middle term) and specific (short term) curriculum goals. If curriculum planners/instructors have broken these goals into specific learning units, they should be able to assess the students' progress without too much difficulty.

- When should such assessment take place? Assessment of student learning by instructors should take place at regular intervals to provide systematic and continuous flow of information back to the students and frequently enough to give both students and instructors ample time to make any necessary modifications in their learning and teaching activities, if the assessment indicates the need to do so.

- How should assessment be done? There are a variety of test and non-test methods that CAAs and schools can employ to assess their students' learning. Because of the uniqueness of the individual project, there will be very few appropriate standardized tests for energy education project instructors to use. Instructors will most likely have to design their own tests, geared to the project's specific learning goals, and reflecting the particular strategies emphasized.

Most projects will emphasize the teaching of energy-related knowledge and skills oriented to the performance of specific energy-related tasks and projects. Assessing the students' achievement of these tasks may call for different types of measures. A pen-and-paper test may not be an appropriate one. Instructors will have to develop tests based on criteria that are appropriate to the specific performance of a practical, skill-oriented task. Here are some criteria that instructors may wish to apply. *

- How long did it take the student to complete the task?
- How much work was required to do so?
- Did the student understand and apply specified ideas and principles?
- How well did the student plan the task?
- How creative was the completed task?
- How effectively did the student communicate the task to the class and/or teacher?

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*These criteria are adapted from John R. Verduin, Jr., Harry G. Miller, and Charles E. Greer, Adults Teaching Adults, Learning Concepts, Austin, Texas, 1977, pp. 165-166.

E. RECAP

THE CURRICULUM MODEL

Goals - Content - Methods - Evaluation

THE STEPS

- Establish a cooperative setting for curriculum design;
- Define the students' learning goals;
- Assess the students' knowledge;
- Assess the students' motivation to learn;
- Define and organize the content;
- Select materials;
- Design and/or select appropriate strategies;
- Assess the students' learning.

SECTION TWO: ACTIVITIES

CHAPTER IV

ENERGY CONSERVATION IN THE SCHOOL

This chapter outlines ways in which energy conservation can be implemented in schools. Local PTAs, school administrators, and CAAs interested in involving their community school in energy conservation will find topics such as energy audits and ways of reducing school fuel consumption discussed. Formation of an energy task force for a school is suggested as a means of organizing and implementing energy conservation measures within the school. A CAA could become an active agent in the formation of such a task force.

With energy being the single most inflationary cost in most school budgets, there is a chance that a portion of the budget for instruction could be sacrificed because of rising energy costs. Any parent, community leader, CAA, PTA, or school administrator concerned with the impact of energy costs on their local schools will find advice in this chapter on how to take the first step in meeting the problem.

A. INTRODUCTION

Many existing school facilities in our country were built in the 1950s and early 1960s. By present standards for energy conservation, a sizable percentage of these schools have outmoded equipment and, in lieu of the energy crisis, were poorly designed. Heating, cooling, ventilation, lighting and hot water use account for the bulk of energy consumption in most schools. Technological advances in lighting controls and heating and cooling equipment now provide opportunities for schools to upgrade their energy efficiency and, in turn, save money. Changes in operational procedures such as heating/ventilating periods (classroom use) can bring substantial savings as well. However, before one can begin taking steps in this direction, it is essential that you know what the school's present energy consumption pattern is and what quantity of energy (e.g., electricity, oil, coal) is being consumed. This quantification of a school's energy use is called an energy audit. There are several kinds of energy audits and a number of private as well as state and federal agencies which would be willing to help you conduct one. The energy audit is useful because it can pinpoint the less obvious areas of energy consumption within a school. Corrective action can be suggested which may cost little or nothing once the wasteful and energy inefficient practices have been determined. Often students can be brought into the school's energy conservation effort, helping the school implement the program. Each of these steps will be briefly discussed in the remaining sections of this chapter. If you feel ready to begin a school energy conservation program after studying this chapter, be sure to contact your State Energy Office for details on potential funding of energy audits and energy conservation measures.

B. COORDINATING AN ENERGY AUDIT

1. Step 1: Planning/Task Force Coordination

The development of a task force that can address the energy problem at your school is a sound first step. The committee could be organized by the principal of the school, or by the local PTA in cooperation with the principal, or, perhaps, by a CAA. Its director should be somewhat knowledgeable about energy and have had previous experience in coordinating and managing projects. This task force should include, if possible, the maintenance officer/manager of plant operation, and the managers of school transportation and food services. Interested teachers, students and parents could also be selected as representatives on the task force.

The major purpose of the task force would be to "get the ball rolling". The task force could help initiate the energy audits, help organize and set priorities for low-cost energy conservation methods at the school, and possibly develop activities for teachers and students to be undertaken on a year-round basis. Officials from state and federal school energy conservation programs could be invited to attend meetings and provide advice on strategies your school might take.

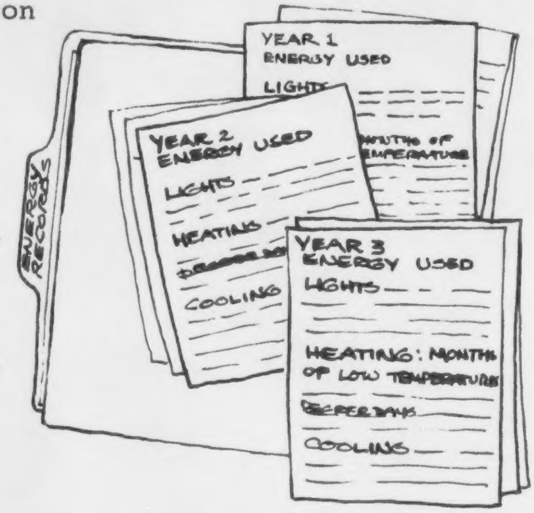
2. Step 2: Energy Audit

Initiating an energy audit in the local school should become one of the most important priorities for the task force or committee. A low-cost, "mini" energy audit is a good beginning. Usually a team of specialists will walk around the school's facilities looking at the building with a critical eye, asking the following questions:

- How many square feet of roof and wall surface area?
- How well insulated are the roof and walls?
- How efficient is the school's heating, ventilating and cooling system?
- What is the school's operational schedule? When is the heating turned on or off? Is the building open nights or weekends?

These and other basic questions that could relate to energy consumption are analyzed.

To conduct an effective audit, the energy consumption data for the past two or three years and energy costs for your school are also needed. By knowing what the historical energy consumption has been at the school (past two or three years) and what the present energy use is (e.g., on a monthly basis), you will be able to pinpoint the most significant and inefficient areas of energy use at the school. Also, as you make progress in the school's energy conservation efforts, you will be able to rate your success by comparing present energy consumption with that of the past.



Other relevant data to be compiled would include the severity of the winters (measured in "degree days"), the number of square feet in the school, and the number of students attending the school. A basic monthly or annual analysis would include:

- fuel energy consumed per square foot of school (BTUs per square foot);

- fuel energy consumed per student (BTUs per student);

- fuel energy consumed per degree day (BTUs per degree day);

- fuel energy consumed per hour of operation during different parts of the day (BTUs/hr);

- energy cost per square foot, per student, per degree day, per hour of operation and for each year studied.

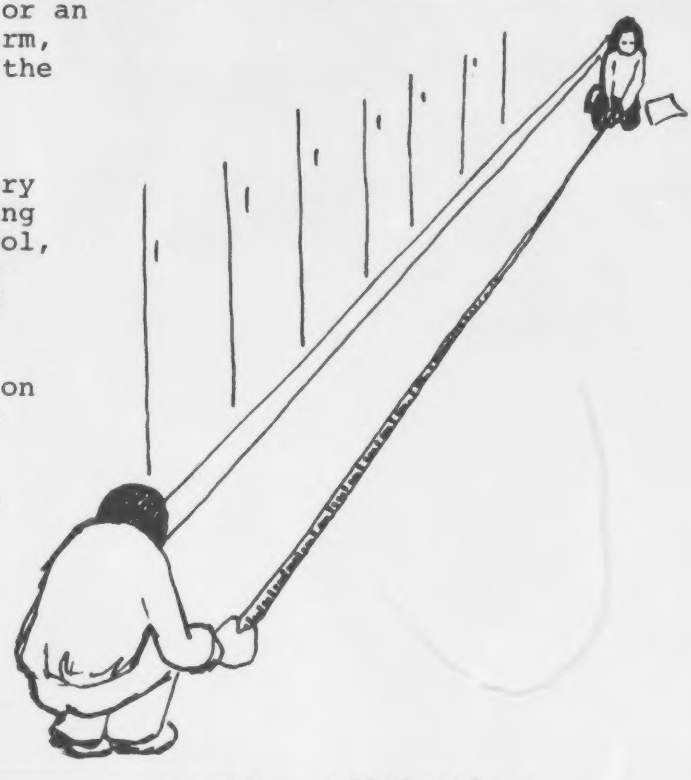
Some of this data could actually be collected and compiled before the on-site mini-energy audit. General science students could do the analysis.

A more complicated and sophisticated maxi-energy audit is a logical extension of a mini-audit. A maxi-audit is conducted by an engineer or an engineering consulting firm, and a fee is charged for the service. The analysis would include:

- a complete inventory of the energy consuming equipment in the school, their operating efficiencies and hours of use;

- specific construction details of the entire school building;

- a complete analysis of all the control equipment for the heating and cooling equipment in your school; for example, how many thermostats are used and where they are located;



- how much certain energy conservation modifications would cost (e.g., automatic controls for night set-back of temperatures) and how long the pay-back would take because of energy savings obtained;

- a calculated energy budget goal for your school as well as the school's present deviation from the goal;

- and a suggested prioritized list of actions that could be taken to reduce energy consumption in the school and help the school reach the energy budget goal.

Over the next 5-6 years, approximately $950 million will be available through this program to schools and hospitals that want to do energy audits and install energy conservation/weatherization materials. Approximately $25 million will be available for audits, with the rest going for equipment purchases, engineering analyses, etc.

The grant program is administered through state energy offices. Within each state, no less than 30% of the state's funding is to go to schools, with no less than 30% to hospitals, while the remaining 40% is split up among schools and hospitals according to the state's priorities.

The state energy offices set priorities as to which schools get weatherization grants, and follow state as well as federal guidelines in doing so. For information on obtaining such a grant, contact your state energy office, or Frank Stewart, Director, Office of Institutional Conservation Programs, Department of Energy, Washington, DC 20585, 202/252-2198. He can also provide you with a complete list of State Energy Offices.

3. Step 3: Low-Cost or No-Cost Energy Conservation Measures

The third step will be the implementation of the school's energy conservation program. The local energy task force can play a significant role at this point in determining which energy conservation measures should be undertaken first, based on the mini- or maxi-audit. The specific activities chosen will very likely include some of those in the following list. Realize, however, that the unique characteristics of a particular school will affect the final selection and priority of activities.

- Reduce building temperatures during holiday and weekend periods. This can save a tremendous amount of energy through a simple readjustment in the operating schedule.

- Switch to a night heating cycle before the school closes for the day. If the school holds evening classes, attempt to schedule them so they fall on the same night and/or within the same area of the school. Then, if possible, heat or cool only the zone in use.

- Schedule custodial care during the day instead of at night in order to reduce heating during the evening. Teach the custodial staff to monitor thermostats and other control devices and report to the maintenance officer if anything seems amiss.

- Reduce the temperature in specialized areas such as gymnasiums and auditoriums. In the case of P.E., instructors can be asked to hold classes outdoors during warm weather whenever possible, allowing the shut-off of air-handling units and lights.

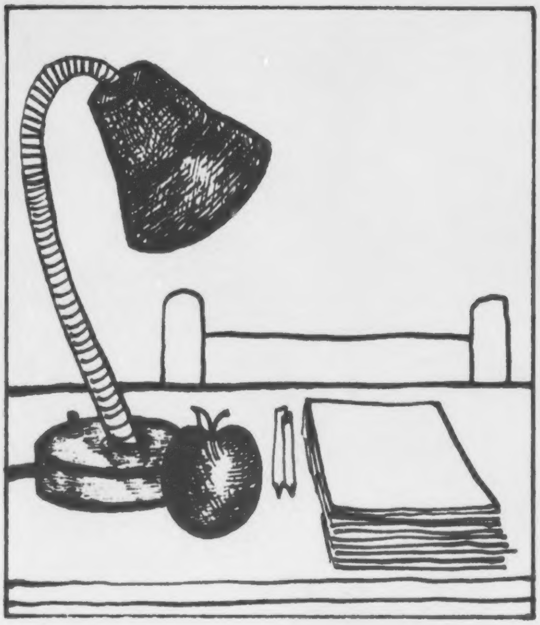
- Reduce outside ventilation to the fewest air changes per hour allowed by state and local codes. Also, do not allow the ventilating system to take in any outside air during the first hour of operation. There is plenty of fresh air in the school if it has been empty for 12 hours.

- During the heating season, close off all vents to air conditioners, which can serve as a major source of heat leakage for the school. Close all other air vents which cannot be regulated.

- Keep burners adjusted for as high a combustion efficiency as possible. A quarterly monitoring schedule (e.g., once at the beginning of the heating season and once midway through the winter) of the combustion efficiencies would be valuable. If possible, send maintenance personnel to workshops and classes on the maintenance of heating equipment. A number of maintenance courses are being offered through some state energy offices free of charge.

There are some energy conservation techniques/methods that will cost some money but will have a rapid pay-back. Those methods applicable to a particular school would be highlighted in the maxi-energy audit. It is likely that one or more of the following would be appropriate to most schools:

- Wherever possible, convert to fluorescent lighting. Also, replace existing fluorescent tubes with new tubes called "energy savers," designed to save 15% in energy consumption with a negligible change in the light level. Develop a maintenance schedule to keep all light fixtures clean. Introduce task lighting where possible. For example, purchase small desk lights for teachers so classroom lighting can be turned off when the teacher wants to study but the class is not in session.



- Install timers to control the heating, ventilating, cooling of gym, auditorium and other special activity areas. Timers to activate/deactivate the total school heating system should be worth the investment as well.

- If there are rooms in the school used more often at night than other rooms (such as the board room or meeting room), space heating and cooling systems could be installed for only these rooms. The entire school does not have to be heated or cooled because one or a few rooms are used.

- Install automatic door-closing devices and make sure doors are well sealed around their perimeters. This improvement can lead to a rapid pay-back for the cost incurred in weatherstripping.

- Reposition thermostats which may be located near drafty areas and therefore give false readings.

- If a school has steam boilers, then the installation of gas or electric water heaters would allow the complete shutdown of the boilers during the summer. Also, the shutdown of the boilers reduces heat leaks that place an extra heat load on air conditioners.

- Check the boiler's burner nozzle for efficiency. Replace it if it is undersized/oversized or worn with age. This simple adjustment can lead to phenomenal energy savings. Also, treat the boiler water chemically to reduce scale and thus increase the boiler's heat transfer efficiency.

- Many pre-1960s school buildings were built with high classroom ceilings. Since hot air stratifies at the top of these rooms, the school's heating system is overworked, heating air at the occupant level. Dropped ceilings in these classrooms, using suspended aluminum frames and insulated ceiling boards can substantially reduce the volume of air in the classroom which has to be heated. Heat transfer through the ceiling can be reduced as well.

- Some older school buildings were originally built with no roof insulation. A maxi-energy audit may specify a rapid pay-back if roof insulation is undertaken.

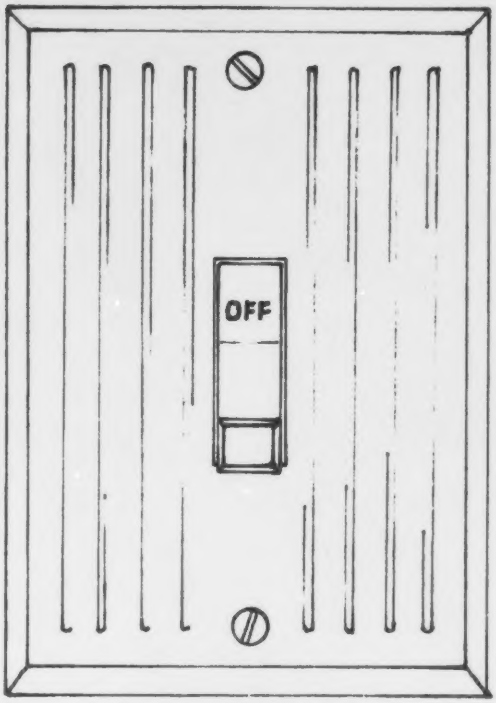
4. Step 4: Student Involvement

Student involvement in an energy conservation program at a school could help in a number of ways. Students could aid in collecting data that in turn could be used by the individuals conducting the mini- or maxi-energy audit. Since many of the same principles apply when conducting an energy audit of a school or home, students could also be taught how to perform energy audits of their homes. They could help in actually implementing certain energy conservation measures at the school and in their home. Their enthusiasm, if sparked, could add to the general overall morale needed to keep an energy conservation program going at the school. And finally, those students who become interested and involved are apt to carry their concerns for energy conservation into their adult lives and the community. Activities involving students could include:

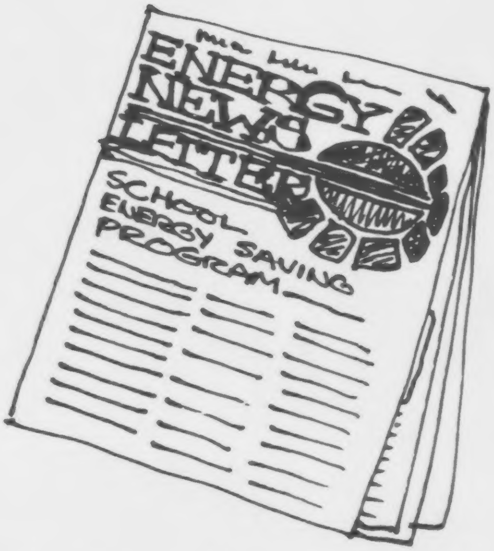
Data Collection: It is often valuable to energy auditors to know how warm or cold the various rooms in the school are at a specified time. This data could help in determining how efficiently the school's heating system is working, how well insulated the various rooms are and whether thermostats are set and physically positioned properly in the rooms. A class could be organized to take and record the building's air temperature in various sections of the school at the same time. A number of classes could be scheduled to record the temperature at differing times of the day throughout a week or two. This data collection should be coordinated with the plant operation manager of the school, to help that person compare data on boiler operation with the actual heating performance data of the school.

Classes could also survey rooms for lighting usage, e.g., whether lights are kept on in unused rooms and whether they are left on after school hours. A survey of lighting in the school could quantify any misuse and pinpoint zones in the school where corrective action could be taken.

Students could also chart the electrical kilowatt hour consumption of the school, as outlined in Activity # 11 in Chapter V. If the kilowatt hour charting was, in turn, tied to the lighting survey of the school, the students would find it easier to associate the theoretical analysis (kilowatt hour consumption) with the reality (percentage of rooms lit but unoccupied). A possible outgrowth of the kilowatt charting and lighting survey might be a concerted publicity campaign within the school directed to the goal of turning the lights off when not in use. Certain students might be placed in charge of turning off lights when leaving the classroom and turning off any solitary lights they notice. It is very possible that an effective campaign stressing light-use management could lead to a substantial reduction of electric usage.



Further Motivational Activities: Another approach to motivate energy conservation among students and teachers would be the development of activities which stress the subject in class. For example, poster contests could be held on the topic, "The best way to conserve energy at our school." Winning posters could be displayed in the hallways of the school or in local store windows.



Students could develop a questionnaire as a class project to survey student and teacher opinion on the various means of conserving energy at school. The results of the survey might be published through an energy newsletter coordinated by the students, or through the student newspaper. Some of the better suggestions might be acted upon by the school administration and/or energy task force. (Suggested as Step 1 in this chapter.)

There are many activities outlined in Chapter V which, if undertaken in class, would help educate students on energy conservation and alternative energy production. For example, one of the outlined activities is the construction and use of insulative curtains. In some cases, insulative curtains might be used in school classrooms or administrative offices and could be made by students, e.g., in home economics classes. Solar and wind energy demonstration projects described in Chapter V can also serve as a means of motivating and interesting students on the general subject of energy.

C. RECAP

In summary, any school can conserve energy and save money. The sooner a school makes a concerted effort in this area, the sooner the benefits will be seen. A specific program of action can evolve from the students, while technically based suggestions would be made by the mini- and maxi-energy auditors and the members of the energy task force organized at a school. State and Federal officials who are concerned with energy conservation will be able to provide advice, and sometimes matching grants, for school projects. With the certainty that energy prices will continue to rise, there is no better time to begin than now.

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CHAPTER V

ENERGY EDUCATION ACTIVITIES

A. INTRODUCTION

This chapter contains a collection of energy activities that could be initiated in cooperation with educational institutions. Many of the activities are of the "hands-on" variety, since student interest and motivation appear to be much greater through direct involvement than through traditional textbook approaches. There are a few activities listed which cannot really be placed in this category. However, they were considered valuable because they were designed to reach a large community or school audience.

Activities range in complexity from simple to difficult. The prototypes listed in this chapter have been classified into three levels of complexity. Level I activities are the simplest to do and usually take the least amount of money and time to complete. Level III activities are at the other end of the spectrum, requiring more time, money, and skill to undertake. Level II activities lie in between.

In a number of cases, the complexity levels of the activities parallel certain grade levels. With a few exceptions, Level I activities tend to be those that can be used in lower grade school classes, Level II activities in secondary level classes, and Level III in secondary as well as college classes.

The audience for each activity is also discussed in this chapter. It was assumed that there were three potential areas where the activity could be conducted: in the school, in the home, or through community affairs projects. However, it will be noted that a number of activities could be done simultaneously in school and home, or, if conducted in school, could have community public affairs impact. As with any interesting project, a little imagination can be used to introduce a concept or idea to many different age groups. A number of Level II and III activities may appear difficult. In some cases, carpentry, welding, or public relations skills are required which lie beyond the capabilities of some instructors. However, many human resources can be tapped by the instructor in the school or community. For example, there are quite often shop, carpentry, and drafting instructors in a high school who can be approached for advice in planning and conducting activities.

In many locales, carpentry classes are held at community colleges; aid from instructors as well as advanced students could be obtained from them. Classes held at vocational/technical schools frequently look for projects such as solar greenhouses which they can undertake. Proprietors of local lumber yards are often aware of names and addresses of local contractors and carpenters, since they sell lumber and supplies to them. These lumber yard merchants should be able to suggest individuals who might provide advice and suggestions on a volunteer basis. Certain citizens have their own home woodworking shops and may be willing to contribute volunteer time.

There may also be community-based organizations already developing, researching, and constructing devices similar to certain Level II and Level III activities. For examples of community-based projects, review the project descriptions in Chapter V. If projects similar to these are being developed locally, a project leader will very likely find some willing advisors for the CAA's energy activity. In all likelihood, a sizable number of individuals in a community have the technical skills that could be applied to an energy education activity and an instructor should not be discouraged if any of the suggested activities appear at first glance beyond his/her capabilities. A little time spent making inquiries should bring positive results.

The practical and manual nature of most of the activities listed in this chapter may seem divorced from educational instruction oriented toward energy theory. In reality, many of these activities offer a fine opportunity to teach theory while grounding the young person's experience in a tangible undertaking. Many of the activities described could also be integrated into an educational cluster where the theories touched on in the first activity are applied to later ones in the cluster. See Chapter I.

For example, in the activity entitled "Shoe-Box Solar Hot-Box," youngsters can become acquainted with the concepts of heat flow and heat equilibrium. If their second activity involved testing insulative materials (as outlined in this chapter), they would once again be introduced to heat flow and to heat equilibrium, but now they would learn how these apply to the insulative capabilites (R-values) of various materials. These first two activities would in turn provide a good theoretical framework for designing a solar greenhouse, for discussing the use of insulative curtains, or for learning the effectiveness of storm windows as a means of energy conservation, since the concepts of heat flow, heat equilibrium and insulation apply to all of these activities.

There are other possible linkages among the activities described in this chapter. The shoe-box solar hot-box could lead to the construction and testing of the can solar collector, and this collector could then be followed with the solar food dehydrator activity. Many of the activities could be subject material for the public relations community outreach projects as well. The kilowatt-hour charting activity, the solar food dehydrator, and the insulative curtains and/or storm windows would be informative subject material for student-initiated television shows. A chart is included to suggest which activities could be logically clustered.

As a final word, these activities are to serve as examples selected from a multitude of possibilities. Many exciting ones were not included or described in depth, because of space limitations. These include energy fairs, an "energy week" at schools, traveling slide shows developed by students, energy calendars designed and sold by students, energy questionnaires to sample parent and teacher opinions, and "energy-saver of the week" contests among primary school classes, to name only a few. In summary, the following activities are selected prototypes and any energy education project should attempt to include more, if possible.

Listed below are the various education activities presented in this chapter. They are grouped into clusters, representing common theoretical threads of ideas and subject matter.

Possible Activity Clusters

Activity Number	Activities Described in this Chapter	Activity Clusters
	Complexity Level I:	
1	Shoe-Box Solar Hot-Box	2,3,5,12,15,16,17
2	Can Solar Collector	1,4,12,15,17
3	Solar Water Still	1,4,12
4	Solar Cooker	1,2,3,12
5	Testing Insulative Materials	1,2,8,9
6	Energy Conservation Poster Contest	All, indirectly
7	Small Demonstration Windmills	10
	Complexity Level II:	
8	Handbuilt Plastic Storm Window	1,5,9,13,16,17,18
9	Insulative Curtains	5,8,13,16,17,18
10	A Small Wind Generator	7,11,16,17
11	Kilowatt-Hour Charting	10,13,16,17,18
12	Solar Food Dehydrator	1,2,4,9,16,17,18
13	Radio and Television Programming	All except 1,4,5,6,7
	Complexity Level III:	
14	Bio-Gas Generator	15
15	Solar Heated Greenhouse	1,3,8,9,13,16,17,18
16	Mobile Energy "Demo" Van	All except 5 and 6
17	Energy "Demo" House	All except 5 and 6
18	Newspaper Course on Energy Conservation and Small-Scale Energy Systems	All except 1,4,5,6,7

B. ACTIVITY DESCRIPTIONS

1. SHOE-BOX SOLAR HOT-BOX

Complexity Level: I

Who Can Do It?

The activity can serve as an effective classroom demonstration project of solar heating from K-6. It can be used as well by parents in the home as an educational activity for their children.

Materials Costs

If the materials can be donated, there should be no cost for building the solar hot-box. Otherwise, the total cost for the hot-box will be around $1.00 (primarily the cost of the thermometer).

Time to Completion

The actual shoe-box solar hot-box can be built in less than 15 minutes. Temperature measurements of the collector's performance might be conducted over a period of 1 hour or at various times throughout the day.

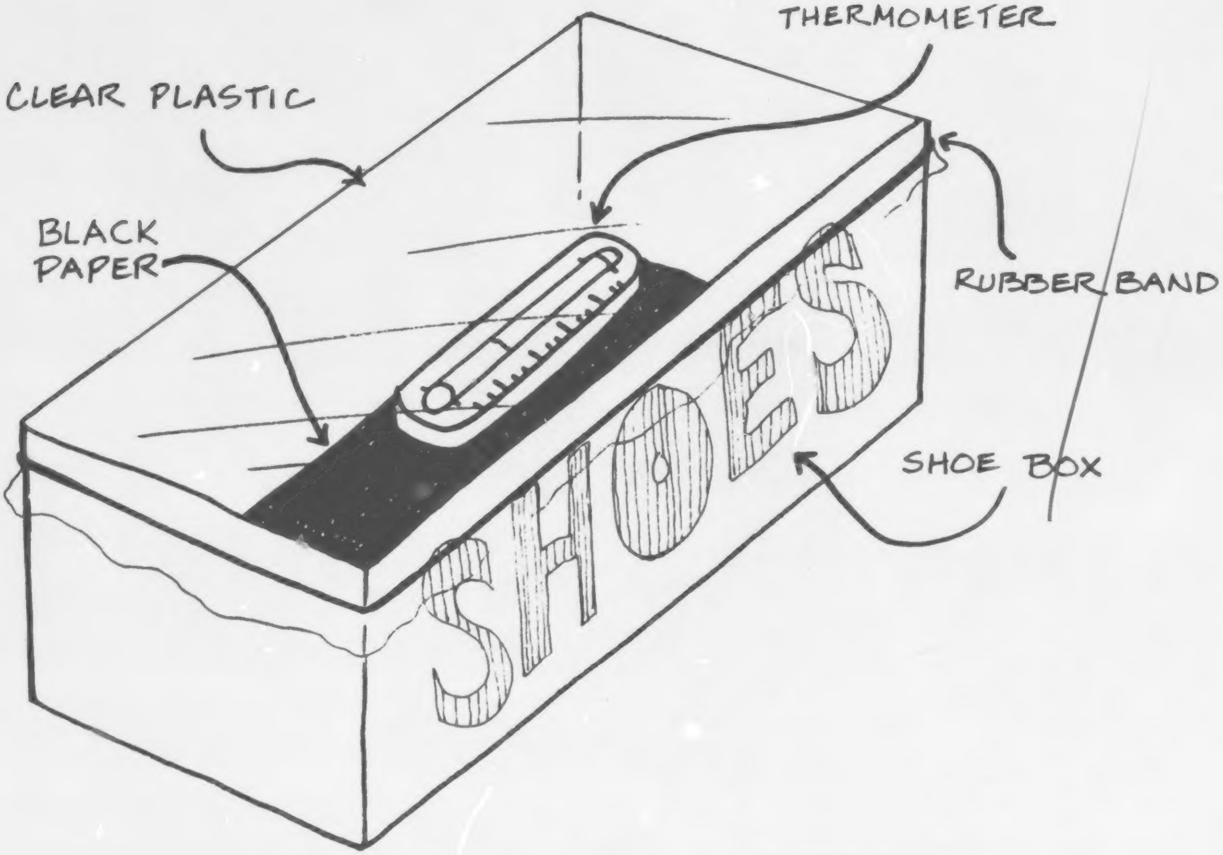
Advantages

Grade-school children can become actively involved in the construction of the shoe-box solar hot-box because the design is simple. Although uncomplicated structurally, the activity can demonstrate several important physical concepts such as temperature equilibrium, heat flow from hot to cold, light transmittance, and radiant heat absorption by different colors.

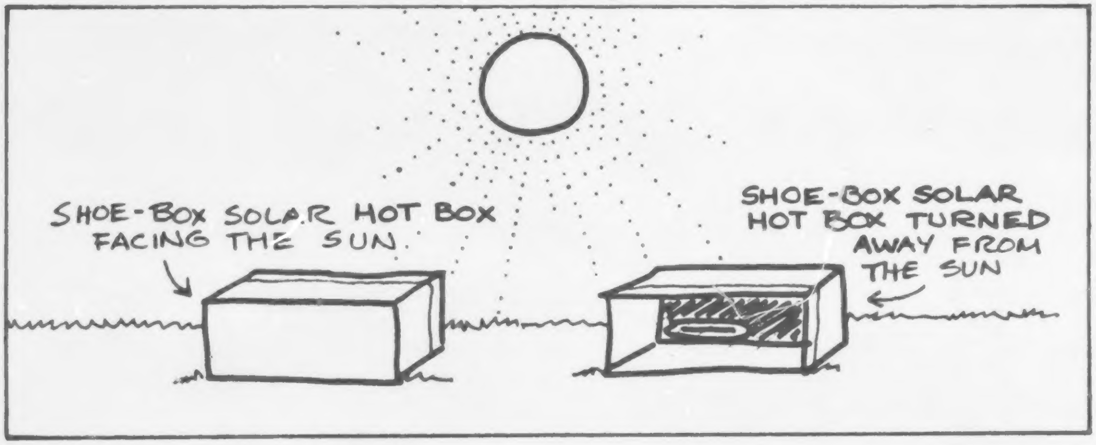
Procedure

Definitions: A solar hot-box differs from a solar collector only in the respect that the solar heat collected and contained in the box is not purposely transferred. The heat from a solar collector is usually transferred from the collector by a heated air or water medium to another location (see "Can Solar Collector," Activity #2). However, in the case of the solar hot-box the heat is simply contained

SHOE-BOX SOLAR HOT BOX



WHICH BOX GETS WARMER? WHY?


SHOE-BOX SOLAR HOT BOX FACING THE SUN.
SHOE-BOX SOLAR HOT BOX TURNED AWAY FROM THE SUN

within the box. The thermodynamic principles for a hot-box are the same as those for a solar collector and those thermodynamic principles discussed in this activity (e.g., heat equilibrium) can be discussed in reference to solar collectors (e.g., the "Can Solar Collector") as well.

The basic materials for this small solar hot-box are: a shoe box (or any small cardboard box), transparent plastic food wrap (or clear polyethylene plastic), colored paper or cloth, rubber bands or masking tape, a thermometer, and a sunny day. Dark-colored construction paper or scrap cloth is cut to fit inside the bottom of a shoe box. A thermometer is placed in the shoe box, and then clear plastic food wrap is spread over the open side of the box with a rubber band or with masking tape. On a sunny day, the hot-box can be set by a southern window or taken outside. When the clear plastic side (the "glazed" side) is directed toward the sun, the inside of the shoe box should heat up quickly.

Teachers can ask their students to bring shoe boxes or other small boxes and thermometers from home. Extra boxes could also be obtained from shoe stores. Thermometers can occasionally be obtained from drugstores as promotional give-aways.

Children can be asked to test the effectiveness of differently colored shoe-box solar hot-boxes as heat collectors. The class can be divided into two groups. One group of students will have lined their hot-boxes with black or dark paper/cloth, the other with white paper/cloth or with aluminum foil. The temperature readings made by the children can be listed on the chalkboard under the headings "dark" and "light." The dark hot-boxes will be warmer, proving that colors absorb solar energy differently.

The solar hot-boxes can be pointed toward the sun as well as away from the sun and their temperatures taken. See illustration. The fact that the boxes facing the sun will be warmer can lead into questions such as, "if a house has windows directed toward the sun, will it be warmer than a house that does not?"

The temperature of an individual shoe-box solar hot-box can be taken over time (e.g., once per minute) after it is directed toward the sun. The temperature rise can be graphed. Does the temperature rise faster on a bright sunny day than on a cloudy day? The outside air temperature can also be taken during the same time that the shoe-box solar collectors' temperatures are being recorded.

If the rise in temperature in the hot-box is recorded, it will be noted that it will soon plateau. The hot-box will then be losing as much heat energy to the outdoors as it is gaining from the sun and is said to be at heat equilibrium. Class discussions can focus on the fact that heat flows from hot to cold, as from the hot-box or collector to the outdoor environment, and that the hot-box or collector will not get any hotter because it is losing as much heat as it is gaining.

As a further activity, the shoe box can be lined with styrofoam or fiberglass insulation. An insulated hot-box can be compared to an uninsulated hot-box in terms of internal temperature. The insulated solar hot-box will be warmer, leading to questions such as "are the equilibrium temperatures of these hot-boxes different?" Yes - because one of the hot-boxes is insulated, it is harder for heat to flow from it to the outdoors. Since the insulated hot-box does not lose heat as quickly, it can get hotter, but the hotter it becomes, the more heat can flow from it to the outdoors. Eventually, it will come to heat equilibrium as well but at a higher temperature. The question may be raised: "should you insulate solar hot-boxes such as solar ovens and solar collectors?" The answer is "yes."

Different materials will allow different percentages of light to be transmitted. This can be demonstrated by placing colored cellophane over one hot-box and clear plastic over another. The children can be asked to take the temperature measurements of these hot-boxes and report as to which has a higher temperature. The clear plastic covered hot-box will be hotter, indicating that more light has been transmitted to the inside of the hot-box and converted to heat.

After they have conducted these various experiments, the children can be asked: "what would be the best and worst designed shoe-box solar hot-box?" -

Best - insulated, black lining within the box, clear plastic glazing; and

Worst- uninsulated, white or aluminum lining within the box, colored glazing.

These models could be built and then temperature measurements of their performance recorded.

Variations on the Same Theme

Solar collector systems could be designed by children using cardboard boxes and small fans to circulate the air through the hot-boxes into a room. Temperature tests could be conducted on solar hot-boxes using double glazing (e.g., two layers of clear plastic versus one layer). A double glazed hot-box would be similar to a double glazed solar collector.

Temperature measuring techniques are discussed in the next activity, "The Can Solar Collector."

2. CAN SOLAR COLLECTOR

Complexity Level: I

Who Can Do It?

Fifth- through eighth-graders should be able to build this simple can solar collector at home or at school. The carpentry skills needed are minimal. Anyone who has used a saw and hammer should be able to construct this collector. Teachers who have had no carpentry experience should be able to obtain advice and aid from the vocational/technical departments of local secondary schools or any friend who has a basic wood workshop at home.

Material Costs

Costs can be little to nothing if scrap materials are used. In fact, it is highly recommended that scrap materials be used to emphasize the concept of recycling "waste" materials as well as to convey the principles of solar heating. If materials are purchased, the cost of the solar collector will be around $2.00/ft^2.

Time to Completion

This solar collector can be built in about 4 hours if all the materials are available. However, it usually takes several days to organize all of the materials.

Advantages

Solar collectors similar to this prototype have been built by sixth- and seventh-graders and have held appeal to students in lower grade levels (one through five) as well. The youngsters' enthusiasm for this kind of solar collector largely stems from the use of materials with which the students are familiar, such as juice cans.

Procedure

Students are asked to bring in coffee cans and large juice cans from home. An old storm window and 3/4-inch exterior grade plywood will also be needed.

The bottoms of the cans are removed, converting the cans into metal tubes. The can-tubes are then taped together with fiberglass tape, forming longer tubes which are in turn painted flat black on their outer surface. Flat-black paint can be obtained from a hardware store; 1 pint should be enough. The length of the tubes is determined by the size of the solar collector box and storm window and will be unique for each collector built. For the best thermal performance, the collector should be 6 feet or longer.

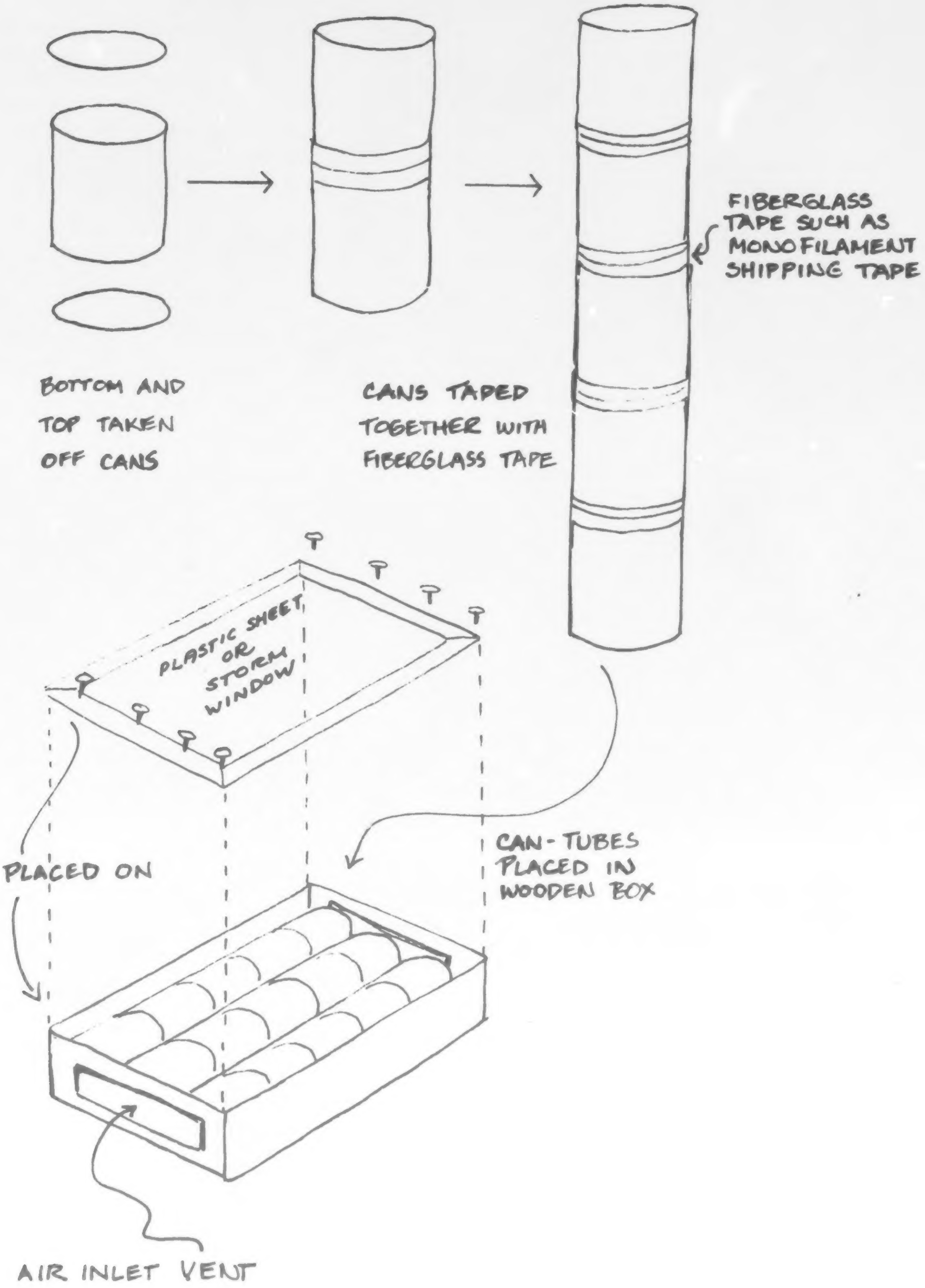
A solar collector box can be built of 3/4-inch exterior grade plywood or shelfing boards. Its width and length are determined by the storm window to be used. However, if one chooses to use clear plastic sheeting (polyethylene) for the collector's glazing, the collector can be made longer than the size prescribed by a storm window. The depth of the collector can be about 1 foot. Air inlet and outlet holes should be cut at either end of the collector box. The storm window can be mounted onto the plywood box with screws and should be sealed with caulking compound. If plastic sheeting is used for glazing, it could be nailed down with wooden laths to the collector's box.

Fiberglass or styrofoam insulation can be placed in the back of the can solar collector. With the collector inclined toward the sun, sunlight passes through the storm window glazing or clear plastic and strikes the black metal tubes. A portion of the sunlight is converted to heat on the flat black surface. The air inside the tubes is heated and begins to rise through the tubes, finally passing out of the hole at the top end of the collector box. Cooler air flows in the hole at the bottom of the box and replaces the heated air that is escaping from the upper portions of the tubes and collector. Under natural, sunny conditions, a collector such as this one has heated air to above 150°F.

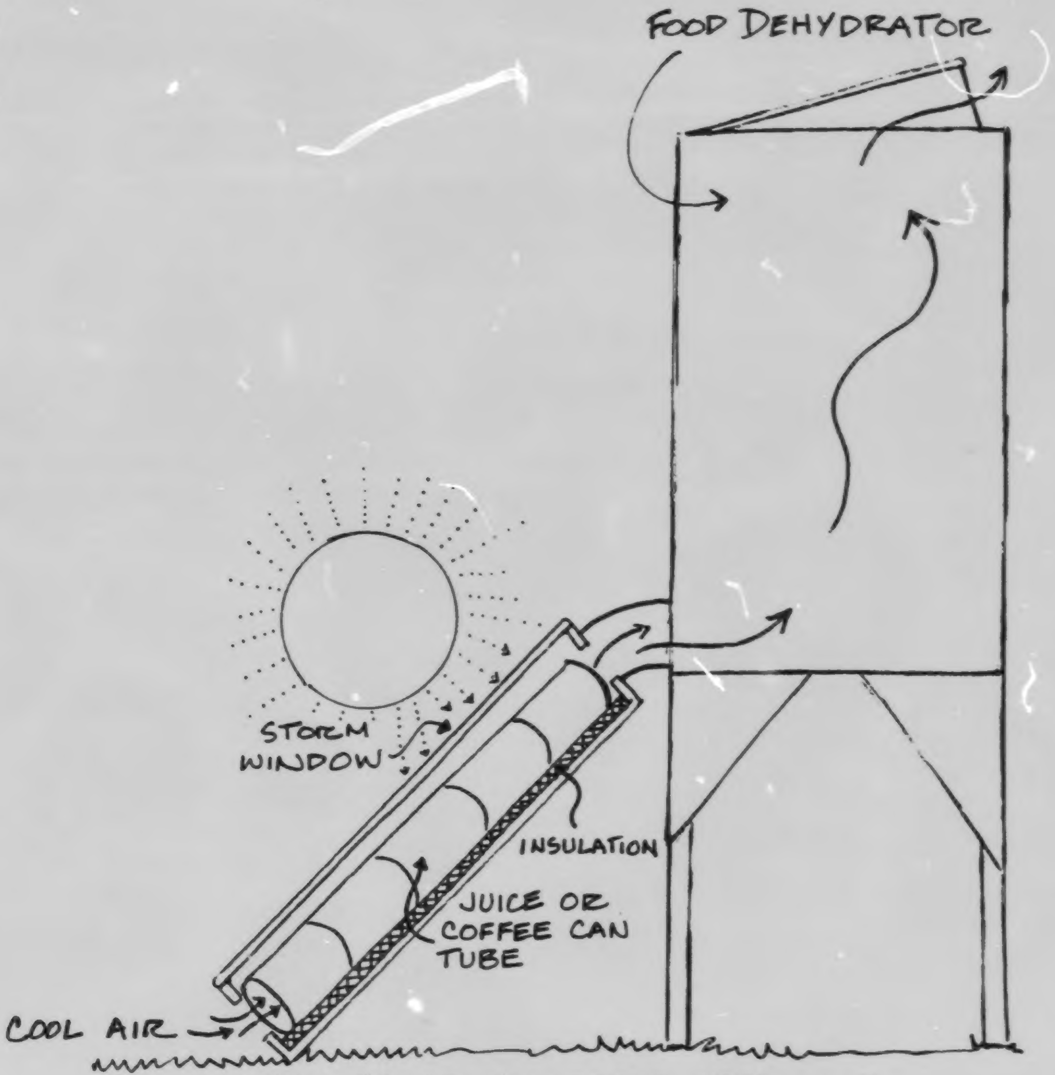
Variations on the Same Theme

Solar collectors of a similar sort can be made from soup cans, dog food cans, etc. Other design modifications are possible as well. For example, rather than taping the cans together, let the students assemble the cans within a chicken-wire "cage" suspended inside the collector box.

CAN SOLAR COLLECTOR


FIBERGLASS TAPE SUCH AS MONOFILAMENT SHIPPING TAPE
BOTTOM AND TOP TAKEN OFF CANS
CANS TAPED TOGETHER WITH FIBERGLASS TAPE
PLASTIC SHEET OR STORM WINDOW
PLACED ON
CAN-TUBES PLACED IN WOODEN BOX
AIR INLET VENT

The cans with their bottoms and tops removed could be laid side by side inside a flat retangular chicken-wire mesh cage. The cage would be suspended midway in the collector's box. Cold air would enter behind the cans, pass through them and exit out of the front of the cans. The collector can be integrated with a solar food dehydrator, as illustrated, to serve a utilitarian purpose. A description of the food dehydrator follows as another project in this guidebook.



CAN SOLAR COLLECTOR USED WITH A SOLAR FOOD DEHYDRATOR

Students could be asked to take air temperature measurements of the air flowing into and out of the collector. By comparing the difference between these measurements, the students should be able to comprehend the effectiveness of the solar collector as an air heater. Air temperature measurements can be taken while the collector is positioned at various angles in relation to the sun. The temperature exiting the collector should be the highest when the collector is perpendicular to the sun's radiation. The class members could be questioned. For instance: "what is the best angle for the collector to gather heat in the winter or the summer?" For a detailed description of collector angles for optimum winter and summer solar collection, see the text entitled The Solar Home Book (included in the references).

The basic means of heat transfer (radiation, conduction, and convection) can be discussed in relation to the collector. For example, the solar radiant energy is absorbed by 'flat-black' metal cans and is converted in part to heat. The heat conducted through the cans can be measured by taping a thermometer to the cans. And the air currents created by heat convection can be demonstrated by holding a smoking match near the air exit of the collector.

References

Direct Use of the Sun's Energy by Farrington Daniels. Available from Ballantine Books, P.O. Box 505, Westminster, MD 21157, $2.20.

Solar Age (a monthly periodical). Available from Solarvision, 200 East Main Street, Port Jervis, NY 12771, $20.00 per year.

Solar Energy Digest (a monthly periodical). Available from S.E.D., Box 17776, San Diego, CA 92117, $28.50 per year.

Solar Engineering (a monthly periodical). Available from Solar Engineering, 8435 North Stemmons Freeway, Suite 880, Dallas, TX 75247, $10.00 per year.

The Solar Home Book by Bruce Anderson and Michael Riordan, 1976. Available from Cheshire Books, Church Hill, Harrisville, NH 03451, $7.50

30 Energy-Efficient Houses . . . You Can Build by Alex Wade, 1970. Available from Rodale Press, Emmaus, PA 18049, $10.95.

3. SOLAR WATER STILL

Complexity Level: I

Who Can Do It?

This simple activity can be conducted at various grade levels to demonstrate solar distillation. This solar still has been used in emergency situations where no fresh water was available.

Material Costs

Material costs are minimal - the price of the plastic sheet only. Used plastic sheets can often be found at construction sites and recycled at no cost.

Time to Completion

This activity can be completed in two hours or less.

Advantages

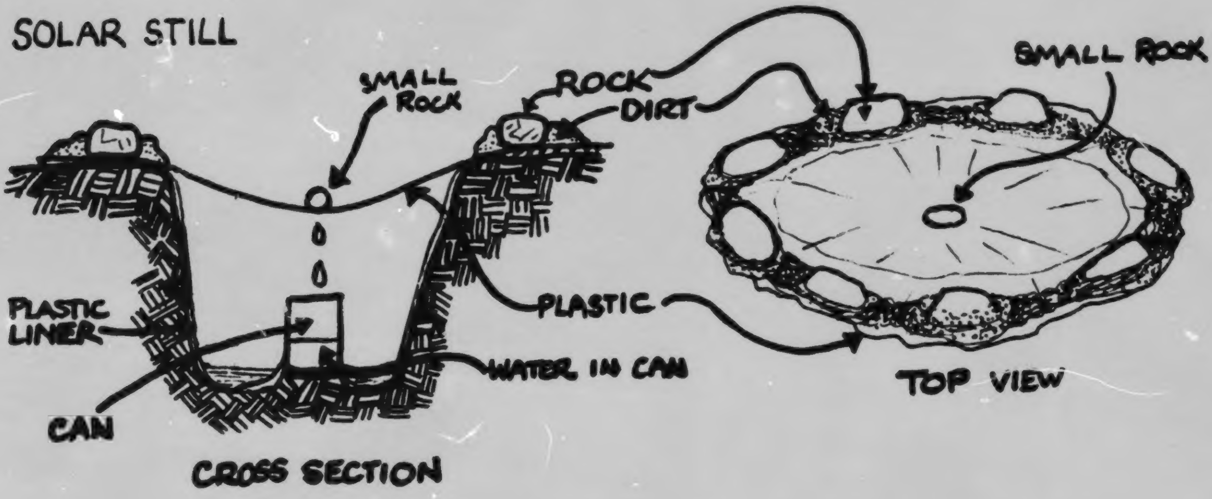
The solar still demonstrates simply and cheaply the ability of the sun to evaporate water. In a sense, the solar still represents in miniature the hydrologic cycle of the earth. The phase changes of water from liquid to water vapor and back to liquid can be discussed. Class discussions can also be elicited on a variety of other points: (1) that water, if heated, will evaporate rapidly; (2) that water actually absorbs heat when it evaporates and must lose heat to condense; (3) that mineral impurities in water such as salt do not evaporate and are left in a crystalline form; and (4) that the sun provides all of the energy needed to evaporate the water and, in fact, drives the entire hydrologic cycle on earth in a similar manner.

Procedure

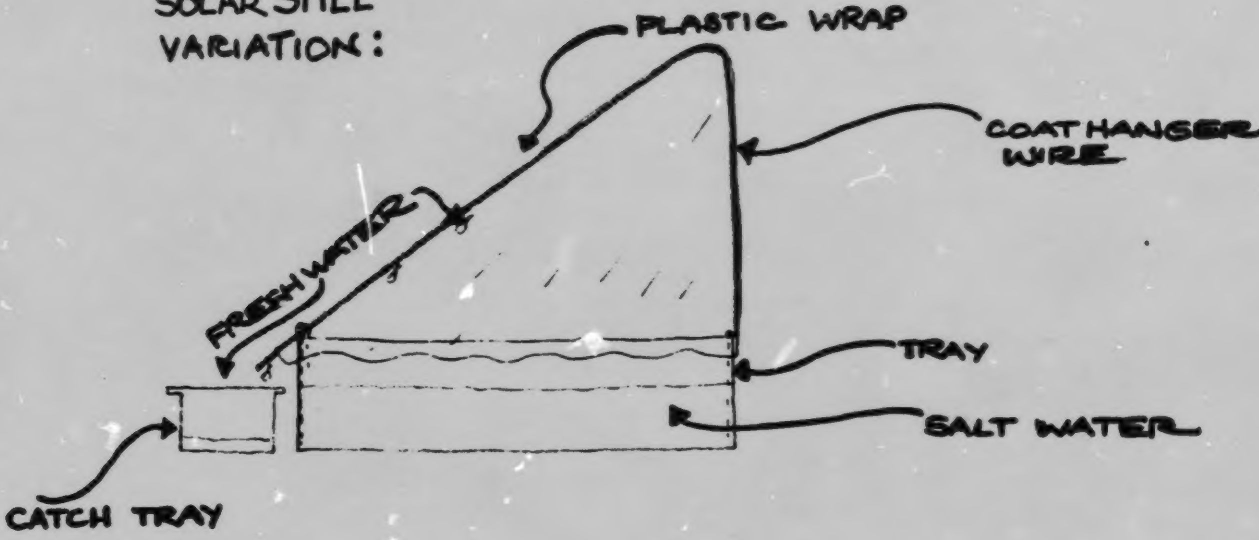
A hole is dug into the ground and a small mound is placed at its base. The hole is then lined with a plastic liner and a small quantity of water poured into the hole. (In emergency survival situations the liner would not be used.) A small can should then be placed on the mound within the hole, and a clear plastic sheet (approximately 4 mil) stretched over the hole and held down at its perimeter by rocks and dirt. Finally, a small rock is placed in the middle of the plastic sheet, directly over the mouth of the can.

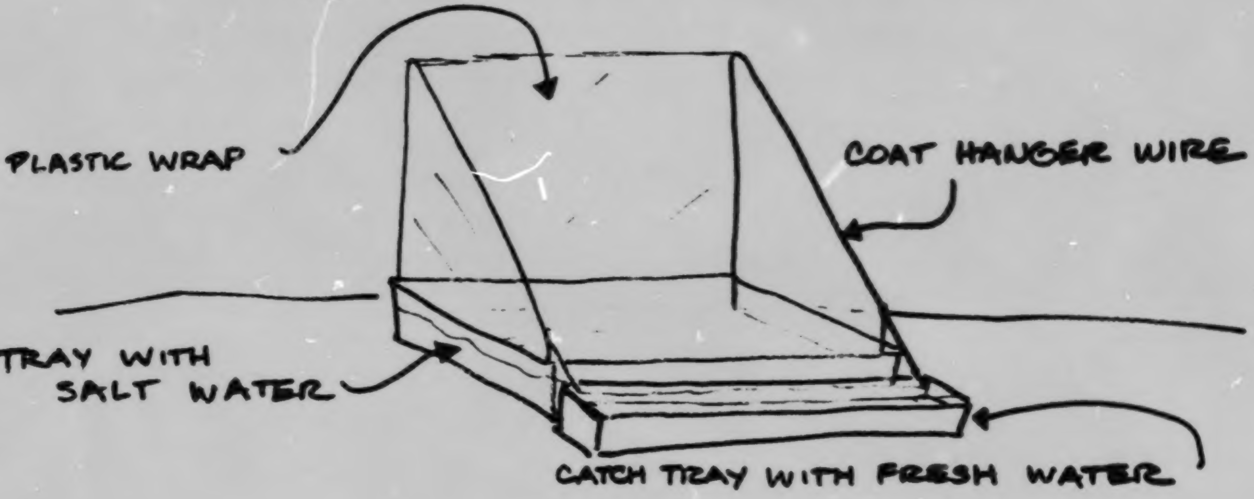
On a bright sunny day the enclosure will heat up quickly. The water originally poured into the hole will evaporate and will then condense onto the underside of the clear plastic sheet. (If the liner is not placed in the hole, then water in the soil would be evaporated.) Water droplets will flow down to the lowest point of the plastic sheet and drop into the can. To demonstrate that when water evaporates it leaves mineral residues, salt water can be poured into the hole. Distilled water will condense and collect in the can while salt crystals will remain behind on the plastic liner.

For classroom demonstrations, a large wooden box could be filled with soil in which the solar still is constructed. The soil-filled wooden box could then be set near a sunny south-facing window.



SOLAR STILL VARIATION:





Variations on the Same Theme

Once the children have been taught the basic principles of solar distillation, they can be asked to devise other solar still designs. Small models can be built and tested in class. One possible model has been illustrated.

Coat hangers are used to make a small A-frame which sits just inside a metal baking tray. If a metal tray is not available, a cut-down cardboard box, lined with plastic, will work. One side of the metal framework should extend out and over the lip of the tray. Clear self-clinging, plastic food wrap can be stretched over the wire framework. If self-sticking film is not available, use polyethylene sheeting and scotch tape. For further support, cardboard can be cut and taped onto the sides of the framework.

References

How to Make a Solar Still (Plastic Covered), "Do-It-Yourself" leaflet L-1, 1973 (13 pages). Available from Brace Research Institute, MacDonald College of McGill University, Ste. Anne de Bellevue, Quebec, Canada 49X 3M1, $1.00.

Manual on Solar Distillation of Saline Water by S. G. Talbert, J. B. Eibling, and G. O. G. Lof, 1970 (263 pages). Available from the Superintendent of Documents, Government Printing Office, Washington, DC 20001, $2.00.

Simple Solar Still for the Production of Distilled Water, Technical Report No. T17, (6 pages). Available from Brace Research Institute (address above), $1.00.

4. SOLAR COOKER

Complexity Level: I

Who Can Do It?

With a little adult supervision, this activity can be conducted by children in grades 2-5, and it is a device that could be built at home as well as at school.

Material Costs

Using home materials, the materials may cost $2.00 at the most.

Time to Completion

It should take slightly more than 1 hour to complete.

Advantages

The solar cooker's performance is an effective demonstration that solar energy is diffuse yet when concentrated can be useful by providing high-grade heat energy.

Procedure

The solar cooker consists of a cone-shaped "box" with four reflective surfaces which direct the sunlight to a small dish. Food can be placed in the dish and cooked on a bright sunny day.

The pattern (see illustration) is sketched onto a poster board. Note that the outside dimensions of the pattern represent a square 22" x 22". Draw diagonal lines (Lines A) from the corners of the square. Where the lines designated A cross in the center, draw a small square (the lines marked B) which will measure 2 inches x 2 inches. This small square will be the area where the cooking dish is eventually placed. The lines marked C, represented as broken lines, are then sketched onto the poster board. By cutting along the broken lines C, a cardboard "Maltese" cross is formed. Aluminum foil is then glued onto each arm of the cross, leaving the center section (the 2-inches-x-2-inches square) free of foil. In the center square, glue a small metal dish like those used to poach eggs. The outside of the metal dish

PATTERN FOR THE COLLECTOR

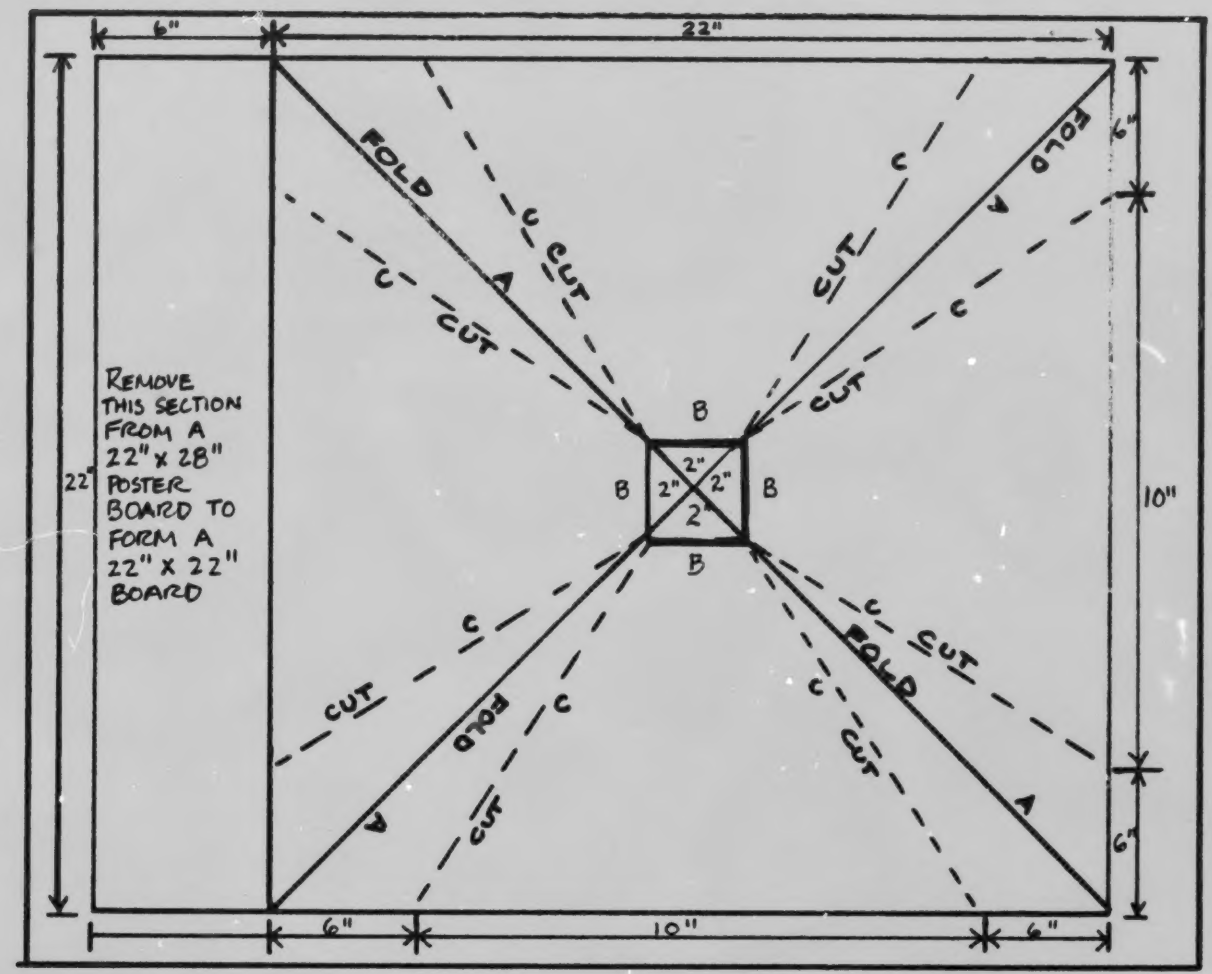
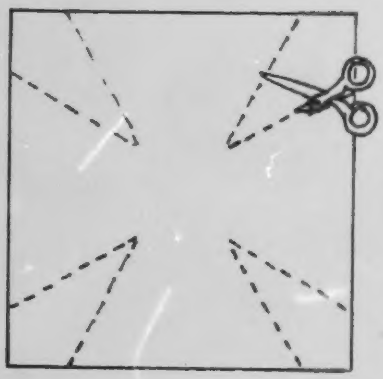

6"
22"
22"
REMOVE THIS SECTION FROM A 22" x 28" POSTER BOARD TO FORM A 22" x 22" BOARD
FOLD
A
B
C
CUT
2"
6"
10"

Illustration and activity adapted from an article entitled, "Here's a Solar Cooker a Child Can Make," by Ulysses Weldon, Alternative Sources of Energy, #34 (see References in Chapter V).

SOLAR COOKER



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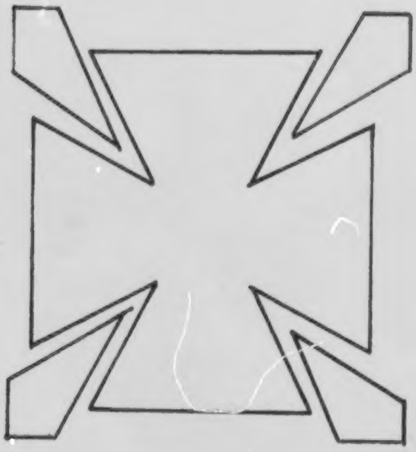

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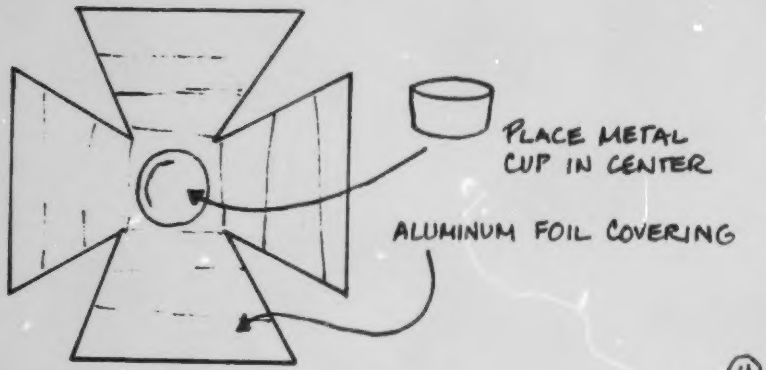

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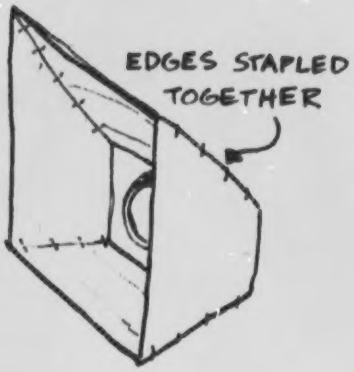

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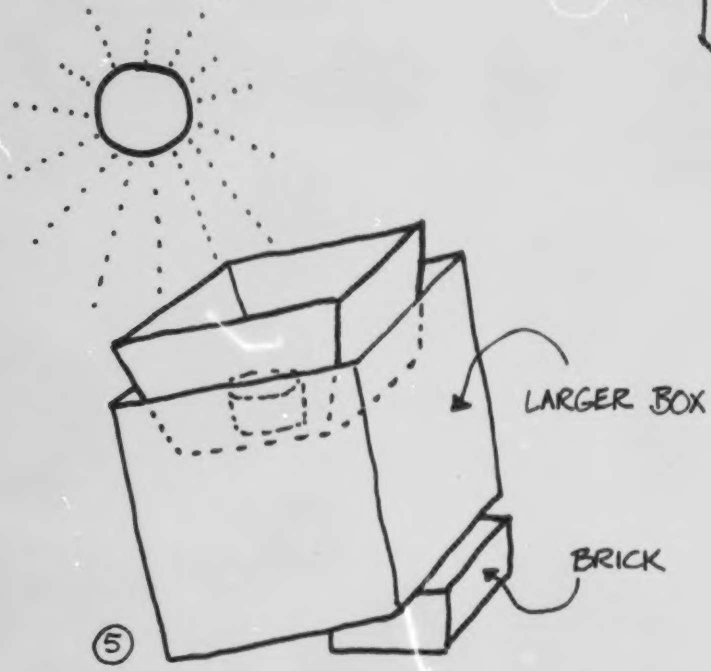


⑤

should be painted flat black; however, the inside of the dish should not be painted unless one is absolutely sure the paint is non-toxic and will not peel off in high heat. Once the dish is cemented, then the arms of the cross are stapled together to form a cone-shaped container.

The solar cooker can now be stapled to another slightly larger cardboard box which serves to stabilize the cooker. A large rock should be placed in the second box as ballast. The elevation of the cooker can be adjusted by propping a brick or two under the box. The solar cooker can develop moderately high temperatures so children should be forewarned. When the cooker is directed toward the sun on a clear, bright day, food placed in the black metal cup (such as a very small portion of hamburger) should cook in approximately 1/2 hour to an hour.

Variations on the Same Theme

In the classroom, this solar cooker project could serve as the basis of discussion about other cooker designs, such as solar ovens and parabolic solar cookers. Refer to the references for more project-related ideas.

References

Alternative Sources of Energy magazine (ASE) carries many solar projects of a build-it-yourself nature. The solar cooker previously described appeared in ASE Issue No. 34 in an article entitled "Here's a Solar Cooker a Child Can Make" by Ulysses Weldon. Single issues are $2.75 and subscriptions are $15.00 per year. Order from Rt. 2, Box 90A, Milaca, MN 56353.

Solar Energy by Franklyn M. Branley, 1957 (117 pages). Available from Thomas Y. Crowell Co., 666 Fifth Avenue, New York, NY 10019, $3.95.

Solar Science Projects for a Cleaner Environment by D.S. Halacy, Jr., 1974 (96 pages). Available from Scholastic Book Services, 50 West 44th Street, New York, NY 10036.

5. TESTING INSULATIVE MATERIALS

Complexity Level: I

Who Can Do It?

This activity can be undertaken in grades 4-7.

Material Costs

If the instructor has access to test tubes, thermometers, small quantities of insulative materials (e.g., fiberglass), then there should be no costs involved in conducting this project. Otherwise, the cost will be on the order of $2.00 per pupil, considering the cost of new thermometers and test tubes.

Time to Completion

Between 1 and 2 hours, accounting for the time involved to record the water temperature.

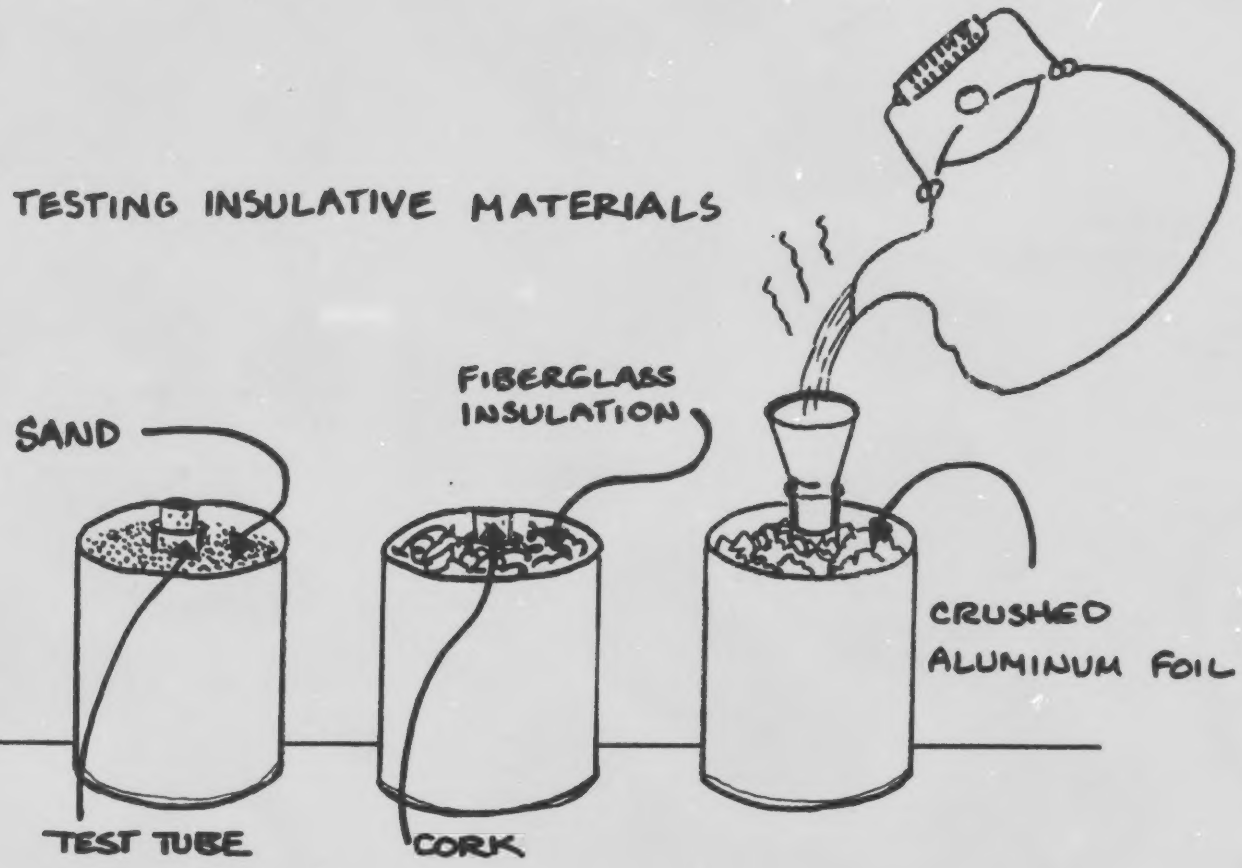
Advantages

The concepts of insulation, thermal conductivity, heat flow from hot to cold, and equilibrium temperatures can be easily introduced and demonstrated.

Procedure

For materials, you will need test tubes of equal size, corks or rubber stoppers for the test tubes, cans (e.g., soup, juice, coffee, etc.) of equal size, insulative and non-insulative materials to be tested (fiberglass insulation, crushed paper, styrofoam chips, sand, aluminum foil, etc.), and thermometers.

Test tubes are held inside the empty cans while insultative or non-insulative materials are packed around them, holding them tightly in place. Note: it is important that the test tubes and cans be of equal size so that the space around the test tubes, occupied by the insulative/ non-insulative materials, will be of equal size as well. This introduces consistency to the experiment. It is equally important that the entire surface area of the tubes be surrounded with the material. The tubes should therefore set deeply within the cans and the insulative or non-insulative material surround the tubes up to their lips.



Water is brought to a boil (100°C). The students are asked to take the water temperature and record their findings. The instructor pours an equal volume of water into each test tube using a small funnel. The tubes are corked, but not too tightly. The tops of the test tubes should now be covered with the materials.

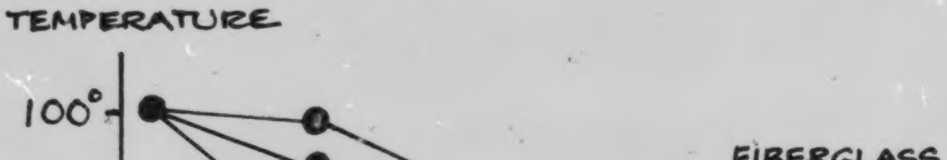
The test tubes and their associated cans can be placed in a refrigerator/freezer to speed up the cooling, or outdoors if the outside air temperature is cold. Every 15 or 30 minutes, the water temperature in the tubes is recorded. The tubes are then returned to the cool environment. This process can be continued as long as the instructor deems necessary. Usually four temperature recordings will provide enough data for a judgment by the class as to which of the materials tested is the best insulator.

The temperature drop of each test tube for the representative insulative material can be portrayed on the same graph on the blackboard. The children should be able to note by reviewing the graph that some of the materials allowed the heat to escape faster than others from the test tubes (see illustration).

A number of interesting comparisons can be made using this project. Wet and dry fiberglass insulation can be compared for their insulative qualities. It will be found that wet fiberglass insulation will be a poor insulator. This experimental comparison can serve to demonstrate that it is actually the small air pockets in the insulation that slow down heat flow. When those air pockets fill with water, the conductivity of fiberglass increases.

The same insulative material, e.g., styrofoam beads, can be tested in different cold temperature regimes. For example, one test tube packed with styrofoam beads can be placed in the freezer where it is below 0°C (32°F) and another in the refrigerator at approximately 7.2°C (45°F). The test tube in the colder environment (the freezer) will lose heat faster, because the difference in temperature between the water in the tube and the freezer is greater. The instructor could use this experiment to prove that the heat flow from hot to cold is greater when the temperature difference between two objects is larger.

AN EXAMPLE OF A GRAPH



If the time is available, the instructor can allow the water temperature in one of the test tubes to reach the same temperature as the cool environment it has been placed within. This can serve as a demonstration that heat will flow from a hot object to a cold environment until it reaches equilibrium with the environment. That is, a hot object will lose heat until it reaches the same temperature as the environment, after which it will stop dissipating heat since a temperature difference no longer exists.

Variations on the Same Theme

Crushed ice of equal volume could be placed in each test tube. After an extended length of time, the test tubes can be checked to see which still have ice and which contain water.

If test tubes are not available, another variation of the aforementioned experiments could be conducted using 1 gallon aquariums. Some aquariums could be surrounded with styrofoam or fiberglass insulation while others are left untouched as "controls". Warm water could be poured into the aquariums and temperature readings taken periodically from both the insulated and uninsulated aquariums.

A number of topics and questions can be addressed after conducting this experiment, e.g., "If a good insulator keeps heat from flowing quickly from a hot object, will it keep heat from flowing quickly into a cold object?" Yes. And, "Would a good insulator be a good conductor?" No, a good insulator is a poor conductor, whereas a good heat conductor, e.g., steel, is a poor insulator.

References

For a detailed explanation on insulation, a very comprehensive section is included in Better Homes and Garbage by Jim Leckie, et al. (1975), available from Sierra Club Books, 530 Bush Street, San Francisco, CA 94108, for $9.95.

6. ENERGY CONSERVATION POSTER CONTEST

Complexity Level: I

Who Can Do It?

Poster contests are well suited for pre-school and elementary students, because of children's enthusiasm at these ages for activities which allow self-expression. Secondary level art and technical drafting students could also be involved in more sophisticated poster contests. At the higher grade levels, a monetary award could be offered, while at lower grade levels this would not be necessary.

The contest could be held within a specific classroom or among a number of classes within a school. If sponsored by a county school district, the contest could be district-wide, involving many schools.

Material Costs

If the contest were held within one class, the only costs incurred would be for drawing paper, crayons, paints, etc., which could be as little as $0.50 per pupil. However, if the contest were district-wide, administrative costs would have to be considered beyond the material costs for art supplies.

Time to Completion

No one timeline can be recommended for the completion of a poster contest, because the project's duration may depend on many factors, e.g., number of schools/students participating, art techniques being taught, in-class versus at-home time for preparation. A poster activity may last anywhere between 2 weeks and several months.

Advantages

By choosing an energy conservation theme, such as "the best way to conserve energy at home" or "the energy wasters," the poster contest would help many children to conceptualize energy conservation techniques. The parents would become indirectly involved as well. If the poster winners were announced in local newspapers and posters displayed in local shopping centers, the theme of energy conservation would reach the community at large. The prize-winning posters could also be published in a calendar format to be distributed to local community organizations.

TURN THE LI
SUN
WE CAN
We can gy
SAVE E
GROW
HERE
GLUE
PAINT
POSTER PAINT
INK
OLD MAG

Procedure

It would be logical for the teacher to spend about a week discussing energy usage and energy conservation techniques before the announcement of the poster contest. This would provide enough ideas for the children to draw upon when developing their own posters. Review the references for general literature on energy conservation that would be applicable for class discussions.

A poster contest could be developed in conjunction with a school by a local CAA. The CAA might provide slide shows, speakers, and topics for the school classes throughout a designated "Energy Week." The CAA could then make arrangements for the judging and announcement of the poster contest winners.

Posters could be displayed in the halls of the schools, at PTA meetings, in community stores, in local newspapers, and at libraries.

Variations on the Same Theme

Community organizations such as Rotary, Lions, Elks, and Optimist Clubs could be asked to donate money to be used as cash prizes for poster contests.

References

Listed below are a few general references on energy conservation that could be used in the class discussions preceding the poster contest.

Explaining Energy by Lee Schipper, Energy Resources Group, University of California at Berkeley, 1976 (71 pages). Available from National Technical Information Service (LBL-4458), Springfield, VA 22161, $6.00.

Making the Most of Your Energy Dollars by National Bureau of Standards/Consumer Information Series 8, 1975. Available from Superintendent of Documents, Government Printing Office, Washington, DC 20001, $0.70.

350 Ways to Save Energy in Your Home and Car by Billy L. Price and James T. Price, 1976 (288 pages). Available from Tab Books, Blue Ridge Summit, PA 17217, $8.95.

7. SMALL DEMONSTRATION WINDMILLS

Complexity Level: I

Who Can Do It?

Under the direction of parents, children could build windmills at home. If used as a school project, they should be suitable for grades K-4.

Material Costs

These windmill projects should cost less than $1.00 each in materials.

Time to Completion

Approximately 1 hour for each windmill, assuming the children do most of the construction.

Advantages

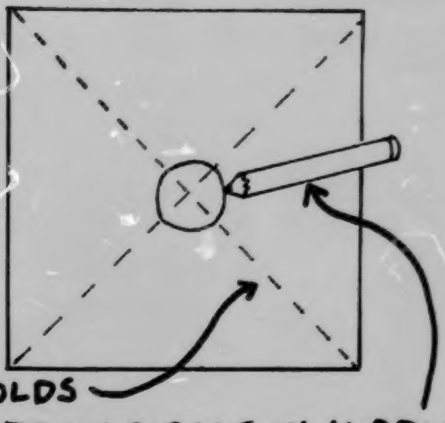
These projects can generate a great deal of interest among the children because of the dynamic movement of the windmills. They are both simple and inexpensive to construct.

Procedure

(A) The Pinwheel Windmill

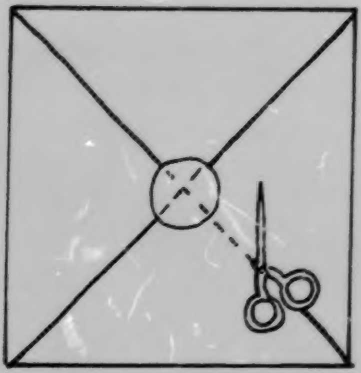
Begin with a square piece of lightweight paper of any size. Allow children to decorate the paper. Now, fold two diagonal creases from the corners of the square piece of paper. Where the creases cross in the center of the paper, draw a circle using a quarter as a template. Cut along the creases to the edge of the circle, leaving the circle uncut. Turn down every other point and run a pin through the four corners that have been turned over. Attach the pin to the top of a stick. The pinwheel windmill is ready for the children to blow on and hold into the wind.

THE PINWHEEL - WINDMILL

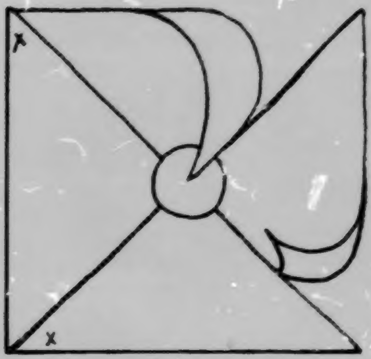


FOLDS

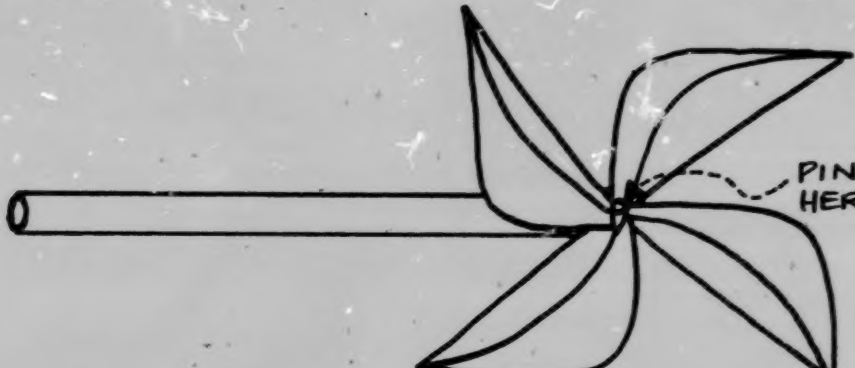
DRAW CIRCLE IN MIDDLE



CUT ALONG FOLDS
TO EDGE OF
DRAWN CIRCLE



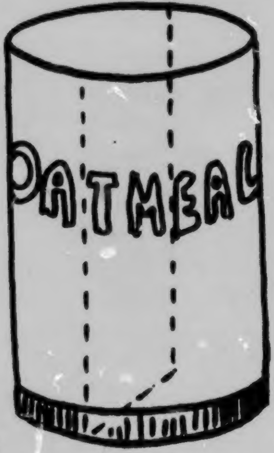
BRING EVERY OTHER
POINT TO THE CENTER



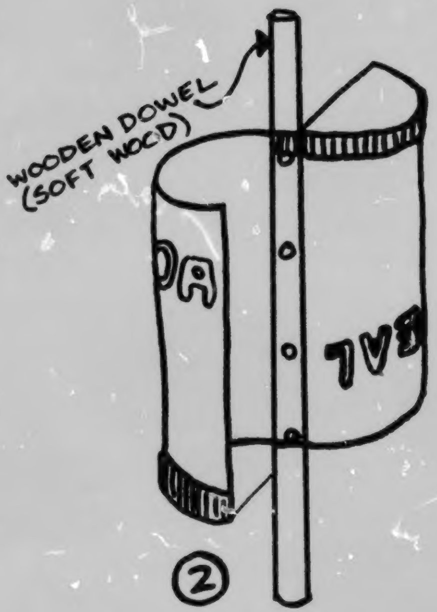
PIN GOES
HERE

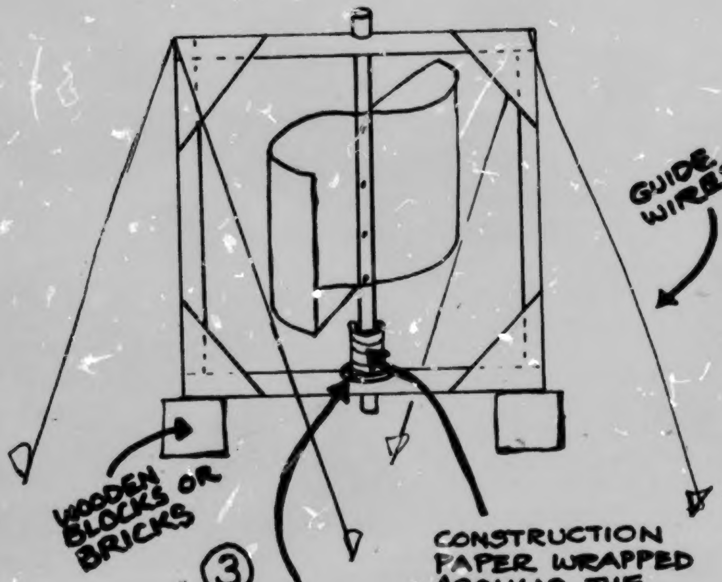
RUN A PIN THROUGH THE FOUR CORNERS THAT HAVE BEEN TURNED INTO THE CENTER. ATTACH PIN TO STRAW OR STICK.

OATMEAL BOX - S-ROTOR



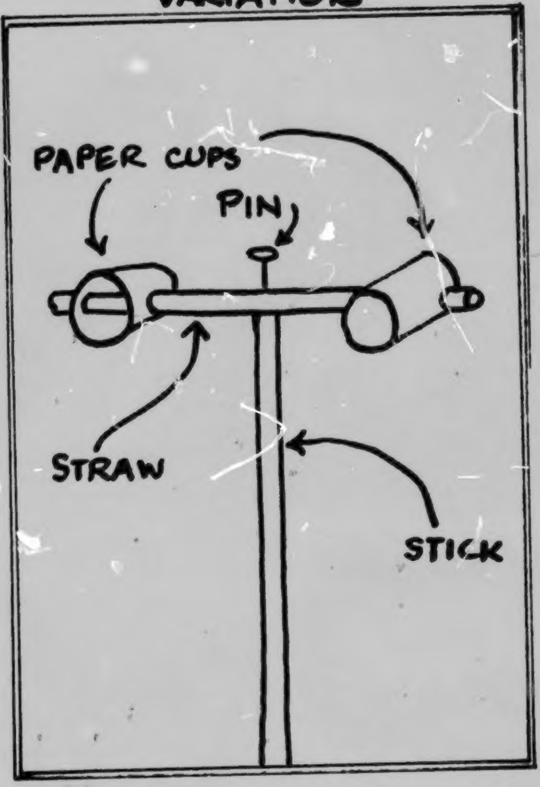
①




GUIDE WIRES
WOODEN BLOCKS OR BRICKS
CONSTRUCTION PAPER WRAPPED AROUND THE DOWEL AND TAPED
METAL WASHER TO SERVE AS LOWER FRICTION BEARING

③

VARIATION



(B) Oatmeal Box "S" Rotor

Take an empty oatmeal (cardboard) box and cut lengthwise exactly in half. Take the halves and tape them together to a long wooden dowel 1/2 inch in diameter, so that the halves form an S-shape when viewed from above. The wooden dowel should extend from either end of the cardboard S-rotor by about 2 inches. Thumbtacks can be used to hold the cardboard halves to the wooden dowel. After the box halves are tacked to the dowel, then glue should be applied to the seam and allowed to dry thoroughly.

The wooden dowel is the axis about which the windmill spins, so a supporting framework must be built to hold the wooden dowel vertically, yet allow it to turn. This supportive framework can be made of heavy cardboard strips, as diagrammed, with holes at either end for the wooden dowel to pass through.

The S-rotor should sit on a washer as indicated in the illustration to keep it from snagging on the supporting framework when it turns. A cardboard strip made from construction paper can be taped around the dowel to serve as such a washer. A metal washer placed below the cardboard strip washer can in turn serve as a lower friction bearing. "Guide wires" (actually made of strings) should be connected to the supporting framework to hold it upright. The guide wires can be held taut by tying them tightly to stakes in the ground or attaching them to a wooden table.

Variations on the Same Theme

Students can be asked to think of other windmill designs they might build. For example, paper cups could be attached at either end of a long plastic drinking straw. Holes can be punched in the sides of the paper cups slightly smaller in diameter than the drinking straw. When the straw is pushed through the holes, the cups should be held firmly in place. Glue can be applied to strengthen the bond between the cups and the straw. Once the glue is dry, the straw can then be pivoted on a stick perpendicular to it by means of a pin. The mouths of the cups should be in opposing directions or the windmill will not spin.

On the lower grade levels to which these small windmill projects are best suited, it would not be feasible to discuss complex wind energy information. However, basic energy-related concepts could be introduced, elicited by the following questions:

If the wind spins the windmill, is the windmill doing work? Yes - in physics, one definition of work is matter (mass) in motion.

What do you think is the oldest machine powered by the wind? The sailboat was used thousands of years ago.

Where does the wind come from? The unequal heating of the earth's surface by the sun creates wind. Warm air rises. Colder air (wind) rushes in to take the place of the rising warmer air.

Is there a lot of energy in the wind? Yes - look at the damage caused by windstorms.

References

For more detailed plans for a savonius ("S") rotor see:

Savonious Rotor Plans, Report #1132.1 ($0.75). Available from Volunteers in Technical Assistance, 3707 Rhode Island Avenue, Mt. Rainier, MD 20822.

Wind and Wind Spinners, Earth Mind, 2651 O'Josel Drive, Saugus, CA 91350 ($7.50).

8. HANDBUILT PLASTIC STORM WINDOW

Complexity Level: II

Who Can Do It?

The construction of a storm window requires the basic carpentry skills developed in high school vocational-technical classes. The use of handbuilt storm windows to conserve energy would most likely interest students in 11th and 12th grades of high school as well as community college students. For that matter, continuing adult education classes could be started by CAAs in the community to teach their construction.

Material Costs

If the plastic sheeting, wood, and other materials are store-bought but the storm windows are hand-made, the maximum cost will be around $0.75 per square foot. Thus, a 10-square-foort window would cost up to $7.50.

Time to Completion

Up to 2 hours for a standard 4-foot-x-2-1/2-foot window. However, as one gains experience, the construction time can be reduced considerably.

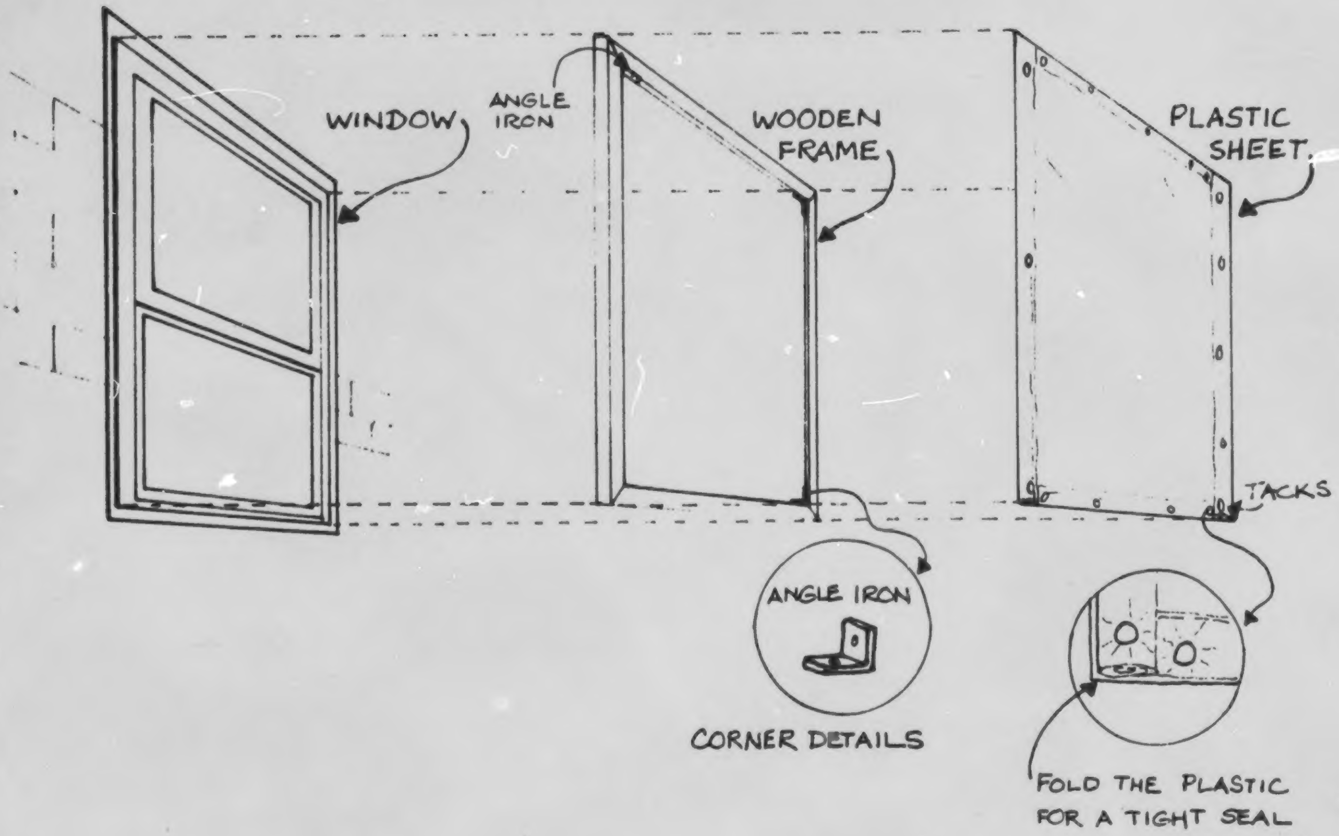
Advantages

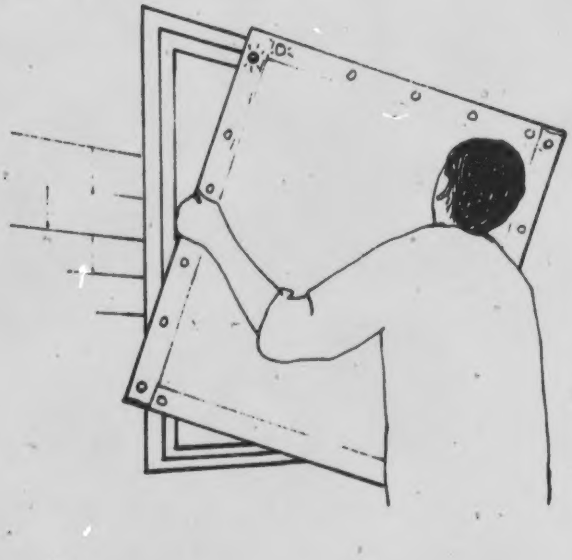
A well-sealed plastic storm window can save between 1/3 gallon to 1-1/3 gallons of fuel oil per square foot per heating season depending on the climate area of the United States. Thus, a 10-square-foot storm window can save between 3 to 14 gallons of oil. It insulates the biggest heat loss area of a house without shutting out sunlight, although the view becomes somewhat fuzzy even with "clear" plastic.

Procedure

The outside dimensions of the window frame in which the storm window will set have to be accurately obtained. The storm window must be installed tightly to keep out drafts. Precise measurements are essential to arrive at a snug-fitting storm window. Wood framing approximately 2 inches x 2 inches should be used; the lengths cut are of course determined by the size of the window

HANDBUILT PLASTIC STORM WINDOW





to be fitted. The rectangular frame for the window should be pre-drilled and screwed to avoid splits in the wood caused by nails.

It is best to construct the corners of the wooden framework as one would construct a picture frame. That is, the end of each of the wooden slats is cut at a 45° angle so that when joined together, a 90° (right angle) corner is formed. There are carpentry tools (miter boxes and vises) that allow one to cut a perfect 45° angle as well as hold two 45° angles together at a corner while you glue and screw the wooden slats together. Ask a vocational-technical teacher, a hardware store salesperson, or a carpenter about these devices.

Now, stretch a heavy plastic sheet (6 to 10 mil) over the wooden framework. Fold the plastic sheeting in a tight roll along the four edges of the framework. Staple using a wood stapling gun through the bunched plastic into the wood framework. Another alternative is to fold the plastic around the edges of the wooden framework and staple the plastic to the back of the framework.

The storm window should fit tightly into the window frame. This can be accomplished by applying weather-stripping along the sides of the wooden frame before it is fastened into the window. Three to four thin nails should hold the plastic storm window in place. The primary window should also be weatherstripped along with the storm window. This prevents moisture from the house moving into the air space between the primary window and storm window and condensing.

Variations on the Same Theme

Clear plastic sheeting for storm windows should be considered a temporary solution since the plastic will deteriorate after 1 year (the wooden framework can be re-used however). The deterioration of the polyethylene plastic is largely due to the ultraviolet radiation in the sunlight. Its major advantage is that it is inexpensive and will help reduce heat loss during the period one is saving for a more permanent commercial storm window.

A far more durable and a bit more expensive alternative is to use clear acrylic sheeting (approximately 1/8 inch thick) instead of the plastic. The acrylic sheeting can be pre-drilled then attached to the wooden framework with small screws. Silicon glue could be applied to create an airtight seal between the wooden framework and the acrylic.

Reference

Save Energy: Save Money! by Eugene Eccli and Sandra Fulton Eccli, 1974, 1977 (48 pages). Available from the Office of Energy Programs, Community Services Administration, 1200 19th St., NW, Washington, DC 20506.

9. INSULATIVE CURTAINS

Complexity Level: II

Who Can Do It?

Ultimately this activity can be used at home as a weatherization technique. However, it could be presented within a high school class, a workshop, or as part of a community educational program involving media, such as a traveling slide show in which construction steps are detailed and shown to community groups.

Material Costs

Approximately $0.75 per square foot area of the window being covered by the curtain. The largest percentage of the cost of this project is in the curtain material. Curtain material, wisely purchased, on sale and in bulk may bring the costs down to less than $0.75 per square foot.

Time to Completion

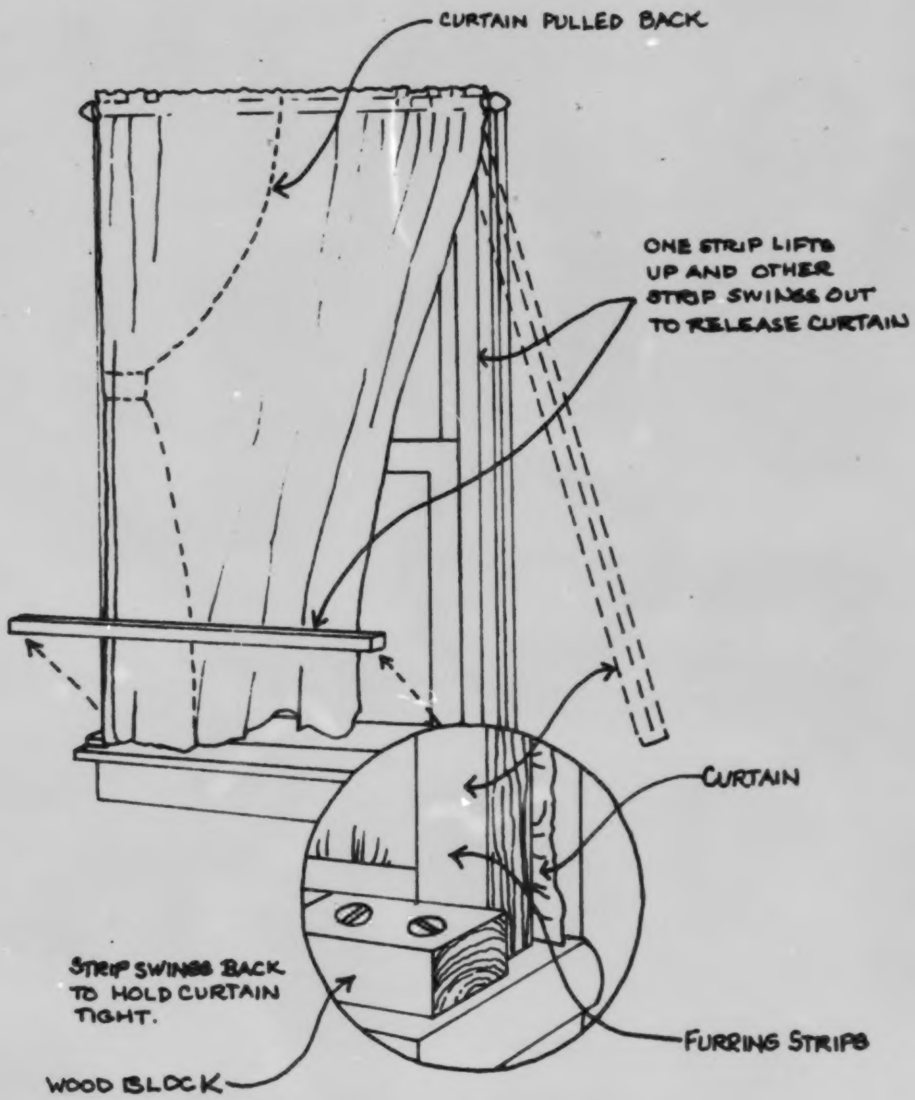
An individual with some sewing experience should be able to make approximately two to three curtains per day for average size windows (2.5 feet x 4 feet).

Advantages

An insulative curtain is a simple but effective means of reducing heat loss from a home. A discussion of its advantages could be integrated with a general class discussion on insulation, perhaps specifically emphasizing R-values of materials.

For example, to convey the importance of insulating curtains, students could be asked to measure the temperature of a wall and window in their classroom by taping a thermometer to these surfaces. The outside ambient air temperature is also taken. Which is cooler, the wall or the window? The window (during the winter) - Why? Because the window is not as good an insulator. That is, it is conducting heat more rapidly to the outdoors. How could this heat loss be prevented? Heat loss can be prevented by placing a material over the window that has a higher R-value. The heat resistance values (R-values)

INSULATIVE CURTAIN


CURTAIN PULLED BACK
ONE STRIP LIFTS UP AND OTHER STRIP SWINGS OUT TO RELEASE CURTAIN
CURTAIN
STRIP SWINGS BACK TO HOLD CURTAIN TIGHT.
FURRING STRIPS
WOOD BLOCK

of various materials could be outlined to the class during the discussion of alternatives for window covers. A comprehensive chapter on insulation and R-values can be found in Other Homes and Garbage (see general references).

Insulative curtains, with their sides and bottoms battened down, can also reduce air convection currents where warm air at the ceiling will move down the windows as it cools. By reducing the flow of air currents past the windows, one can reduce the heat transferred from the room to the windows.

Procedure

An effective insulative curtain is comprised of three major components: (1) lightweight curtain liner which is composed of insulative material; (2) a tightly woven cloth which serves as the curtain material; and (3) a means of battening down the sides and bottoms of the curtains and curtain liners, to reduce air convection past the window.

The curtain liner can hang separately from the curtain so the curtain can be washed when need be. The curtain liner should be made of an insulative material that is lightweight and easy to handle. A material called continuous fiber polyester, available under a variety of trade names, meets these criteria. It is a puffy cloth-like substance having dead-air spaces that retard heat flow. Continuous fiber polyester can be obtained as a blanket batt in various thicknesses and sizes. Inexpensive cloth covering should be sewn over both sides of the blanket batt. To keep it from stretching, the cloth should also be tacked to the middle of the batt.

The curtain which hangs in front of the curtain liner should be thick and of a tight weave. These qualities help to prevent air flow through the curtain and, in turn, heat transfer. The curtain should also be light colored if possible to reflect light into the room.

A means to batten down the sides and bottom of the curtain is the final important ingredient in an effective insulating curtain design. The sides and bottom of the curtain can be held tightly to the window frame through the use of furring strips. Review the illustration for details. Small wooden blocks are attached (e.g., screwed) onto the base of the window sill. Furring strips are then placed against the sides of the curtain forming an airtight seal and are held in place against the wooden blocks. Another alternative (not pictured) for battening the curtain to the sides and bottom of the windows involves the use of

Velcro strips. Velcro makes temporary bonds that can be re-bonded indefinitely and strips can be placed on the curtain and window frame.

A cap for the top of the curtain reduces heat convection as well. The cap can be made by attaching a piece of material to the top and sides of the window frame. It should drape down over the top and front of the curtain rod and curtain by about 6 inches. The material should lie flat against the curtain to form an airtight seal. The cap should be stretched taut and tacked to the window frame.

Variations on the Same Theme

Curtains are just one means of window insulation. Indoor and outdoor insulative shutters are also a means of reducing heat flow through windows. A number of the references provide examples of insulative shutters. One possible approach, for example, is to cut insulative styrofoam board so it will fit to the bottom half of the window. Styrofoam, however, is flammable and, therefore, a potential fire hazard.

References

Low-Cost, Energy-Efficient Shelters for the Owner and Builder by Eugene P. Eccli (ed.), 1976 (400 pages). Available from Rodale Press, Inc., Emmaus, PA 18049, $7.95. The design for the previously described insulated curtain came from a chapter written by William K. Langdon in this text. Designs for insulative shutters are also presented and are well worth studying.

Save Energy: Save Money! by Eugene Eccli and Sandra Fulton Eccli, 1974, 1977, Office of Energy Programs, Community Services Administration, 1200 19th St., NW, Washington, DC 20506 (CSA Pamphlet 6143-5), free.

Special Section on Window Treatment, Alternative Sources of Energy, No. 31, April 1978. Alternative Sources of Energy, Inc., 107 So. Central Avenue, Milaca, MN 56353, $2.00. Includes detailed plans for making insulated curtains designed by Abby Marier.

Thermal Shutters and Shades by William A. Shurcliff, 1977 Fifth Edition. Available from W. A. Shurcliff, 19 Appleton Street, Cambridge, MA 02138, $12.00. A listing of over 100 schemes for insulating windows.

Window Design Strategies to Conserve Energy, NBS Series 104, 1977 (209 pages). Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20001, $3.75. A very complete description of various commercially available methods of reducing heat loss from windows.

10. A SMALL WIND GENERATOR

Complexity Level: II

Who Can Do It?

Advanced science students in junior high school could build this wind generator. However, it could serve as a wind demonstration project even at the community college level.

Material Costs

Could be as high as $40.00 if all the parts are purchased. However, costs can be cut if recyclable parts are used.

Time to Completion

At least 16 hours should be allocated for the wind generator's construction. This does not include the time involved in locating the parts.

Advantages

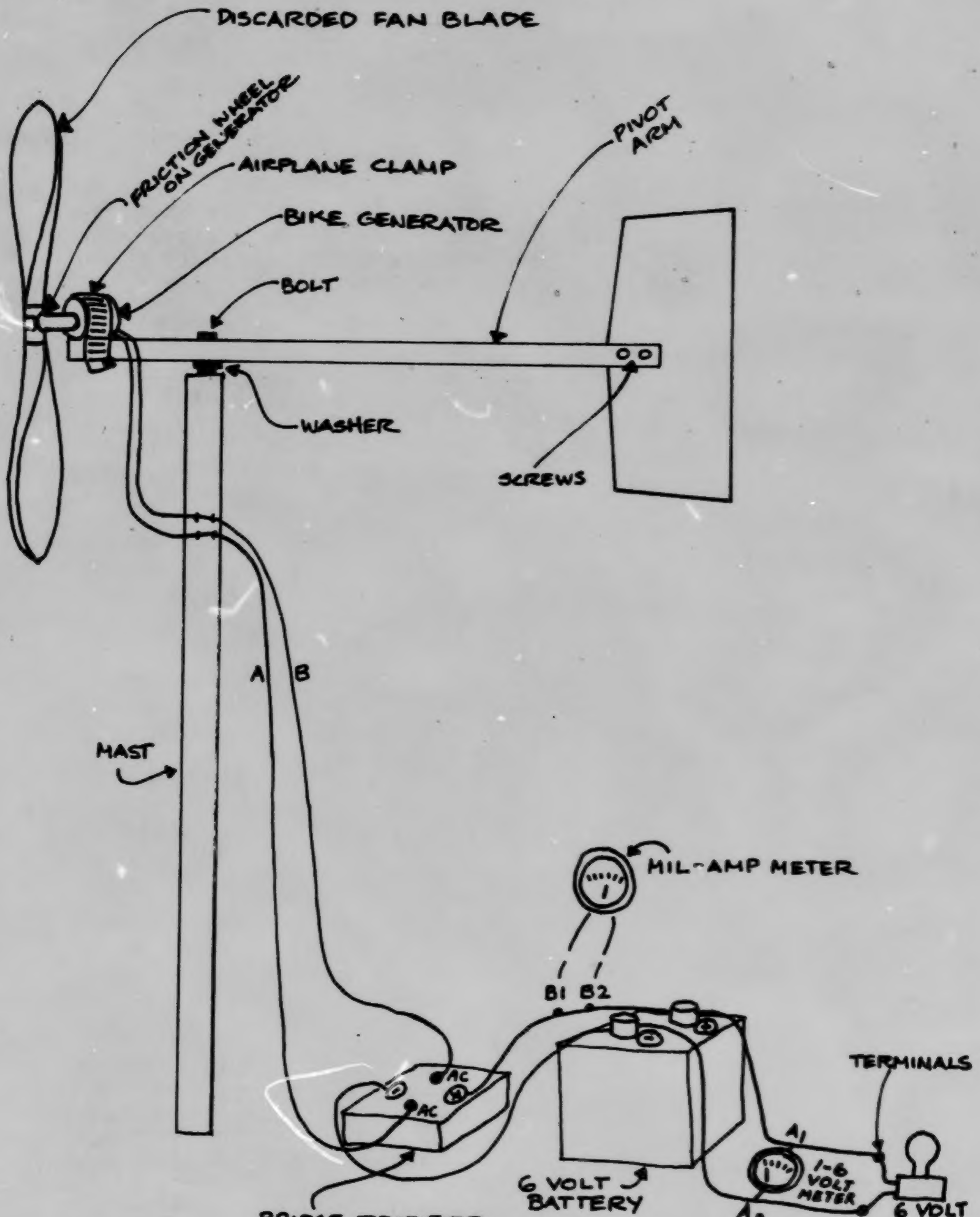
A minimal amount of skill is needed for this wind generator's construction and it can provide a working demonstration of the conversion of kinetic wind energy to electricity.

Procedure

This wind generator prototype involves a propeller or blade connected to a bicycle generator. The bike generator is in turn connected to a pivoting arm with a tail. The electrical current generated is stored in a battery.

A bicycle generator (6 volts, 3 watts) is the major component of this system to convert the kinetic wind energy to electricity. Since the electrical current generated is alternating (A.C.) it needs to be converted to direct current (D.C.) if it is to be stored in a battery (6 volts). A semiconductor diode serves as a bridge rectifier to transform the 6 volt A.C. to a pulsating 6 volt direct current. A salesperson at a local electrical parts shop

SMALL WIND GENERATOR



or someone versed in electronics should be able to help in locating the bridge rectifier (IR 18DB7A). To demonstrate the practical use of the electrical energy being generated, a small 6 volt D.C. radio or light can be connected to the battery. The 6 volt D.C. battery can be obtained from various surplus houses. Nickel cadmium batteries such as the rechargeable varieties used for portable tools should serve the purpose.

A discarded fan propeller can serve as the blades for the wind generator. Students could also experiment by constructing and designing their own blades. Certain references listed at the end of this activity discuss blade construction. See Alternative Sources of Energy, issues #14, 20, 24, 29, and Jack Park's book Simplified Wind Power Systems for Experimenters.

The friction wheel of the bike generator hopefully will fit into the hub of the discarded fan blades. If the hub is too large, metal contact cement such as aluminum glue (obtainable at a local hardware store) can be used. If the hub is too small, a rat-tail file may be needed to enlarge the hub hole to size.

A pivot arm made of wood about 1" x 1" and 3 feet long should be obtained. A tail is attached by screws to one end of the pivot arm. The tail, made of wood or metal sheeting, should be built with 2 square feet of surface area. The bike generator (with blades) is then mounted on the other end of the pivot arm. Airplane clamps or wire can be used to hold the generator to the pivot arm.

Once the tail, generator, and blades have been mounted, one can experiment with balancing the pivot arm on one's finger. After a few trials, one will discover the position on the pivot arm where the weight of the tail is equally balanced against the weight of the generator. This "balance point" should be marked and a hole drilled at that spot. A bolt is then passed through the hole and attached to the pole where the wind generator is to be permanently placed. A washer should be placed between the pivot arm and the pole.

The wires that run from the generator and down the windmill pole (see illustration) should have enough slack in them so that the windmill can turn easily into the wind without binding. The wires can be periodically unravelled should they become tangled.

Variations on the Same Theme

The class can connect a small 6 volt light to the generator and watch it brighten as the wind speed increases.

Several concepts are important to mention. If the wind speed doubles, the power that the generator can put out increases by a factor of eight. If the diameter of the propeller is doubled, the power that the generator can put out is increased by a factor of four.

Students could analyze the power output at various wind speeds by using a hand-held wind speed indicator and checking the power output with multi-amp. meters (connected at points A_1A_2 in circuit diagram) and with 1-10 volt voltmeter (connected at points B_1B_2 in circuit diagram).

References

Alternative Sources of Energy magazine has carried a number of articles on handbuilt wind generators. The activity given in this guidebook was adapted from "Low Power Windmill" by John McGeorge, February, 1978, issue. Other issues which have covered wind generators as well as blade construction are #14, 20, 24 and 29. Single issues are $2.00 and subscriptions $15.00 per year. Order from Rt. 2, Box 90A, Milaca, MN 56353.

Simplified Wind Power Systems for Experimenters by Jack Park (73 pages). Available from Jack Park, Box 445, Brownsville, CA 95919, $6.00. Provides basics on designing windmill blades.

Wind and Windspinners by Michael Hackleman, 1974 (139 pages). Available from Earthmind, 5246 Boyer Road, Mariposa, CA 95338, $7.50. A "how-to" book on building S-rotor wind generators.

11. KILOWATT-HOUR CHARTING

Complexity Level: II

Who Can Do It?

This activity can be conducted from grade 6 through college level. It is also a project that can be implemented by homeowners who want to know their exact electrical consumption.

Material Costs

Minimal costs for graph paper, ruler, etc.

Time to Completion

This project could, in theory, be extended over a year to gain seasonal information on energy consumption. But individuals undertaking the project for only 1 month (which is more likely) will gain enough information about their energy consumption to alter some of their "energy wasteful" behavior patterns.

Advantages

This project is a very inexpensive way to involve the entire family in energy conservation activities.

Procedure

There are two major steps involved in this activity. The first step is to teach a family member, either student or adult, how to read a kilowatt-hour meter. The second step is to organize the electrical consumption data in a chart kept in a conspicuous place in the home, e.g., on the refrigerator. As the family begins to reduce their electrical consumption by turning off lights, turning down electrical heaters or air conditioners, etc., the results of their efforts are displayed graphically on the chart. The chart is visible proof of the family's successful attempts to save energy.

Electrical readings should be taken each week at the same time (e.g., after the Saturday night news). The PRESENT reading should always be higher than the PREVIOUS reading. The subtraction of the PREVIOUS from the PRESENT will yield the NET kilowatt-hour consumption for that one week.

In the example, the previous reading is 4,882 kilowatt-hours. The present reading is 4,982 kilowatt-hours. Therefore, 100 kilowatt-hours were consumed in this one week [present(4,982) - previous(4,882) = net(100) kilowatt-hours].

The net kilowatt-hours of electrical energy used each week would then be graphed and the chart placed in a conspicuous place for all members of the family to review. Note the illustrated example of such a chart where the vertical axis represents kilowatt-hours and the horizontal axis represents the date.

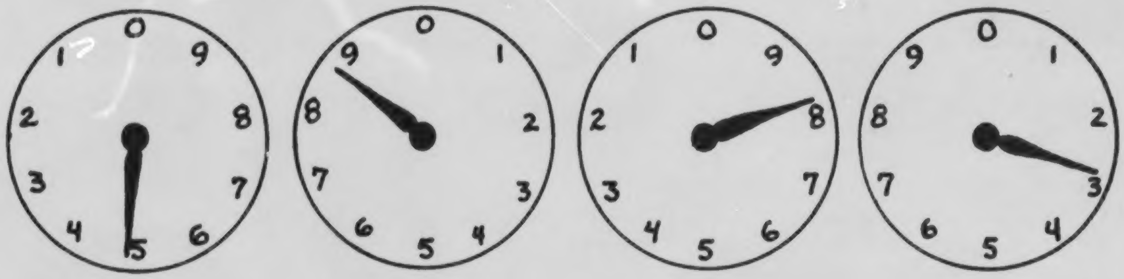
If most of the students in the class live in apartments and do not have access to separate electricity meters, the instructor could help the class read and record the kilowatt-hours consumed at the school each week. However, if most of the students live in homes that have electricity meters, then the teacher could ask them to read their meters to figure a weekly class average of kilowatt-hours. In this way, a class average chart could be developed.

Another alternative would be for the students to work out a "buddy system" to share the available in-home meters with those students who do not have access to meters.

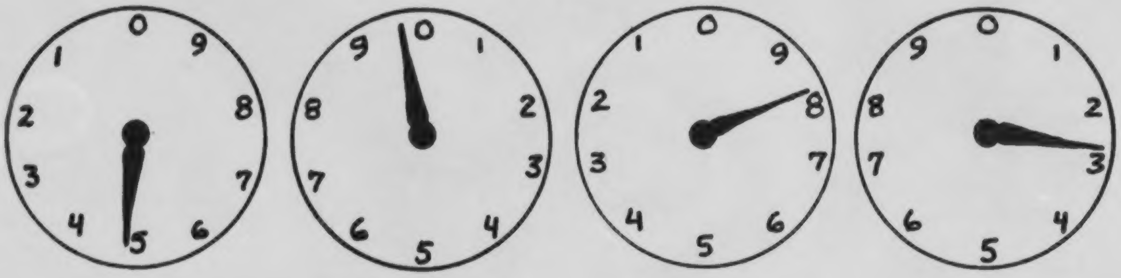
Various methods of reducing electrical consumption at home or at school can be discussed in class. Discussions might focus on which electrical appliances consume the most electrical energy (furnaces, dishwashers, toasters, air conditioners, water heaters, etc.), and which appliances are used most often. Some specific methods for reducing consumption could be suggested: turning down the water heater thermostat from around 150°F to 110°F; opening the door of the dishwasher during the dry cycle and letting the dishes air dry; using the air conditioner as little as possible; etc. (For more suggestions on ways to reduce electrical consumption, see the references listed at the end of this project description.) Teachers could ask their students to talk with their parents, giving them energy conservation "tips," leading to involvement by the parents in kilowatt-hour charting and analysis projects.

HOW TO READ THE METER

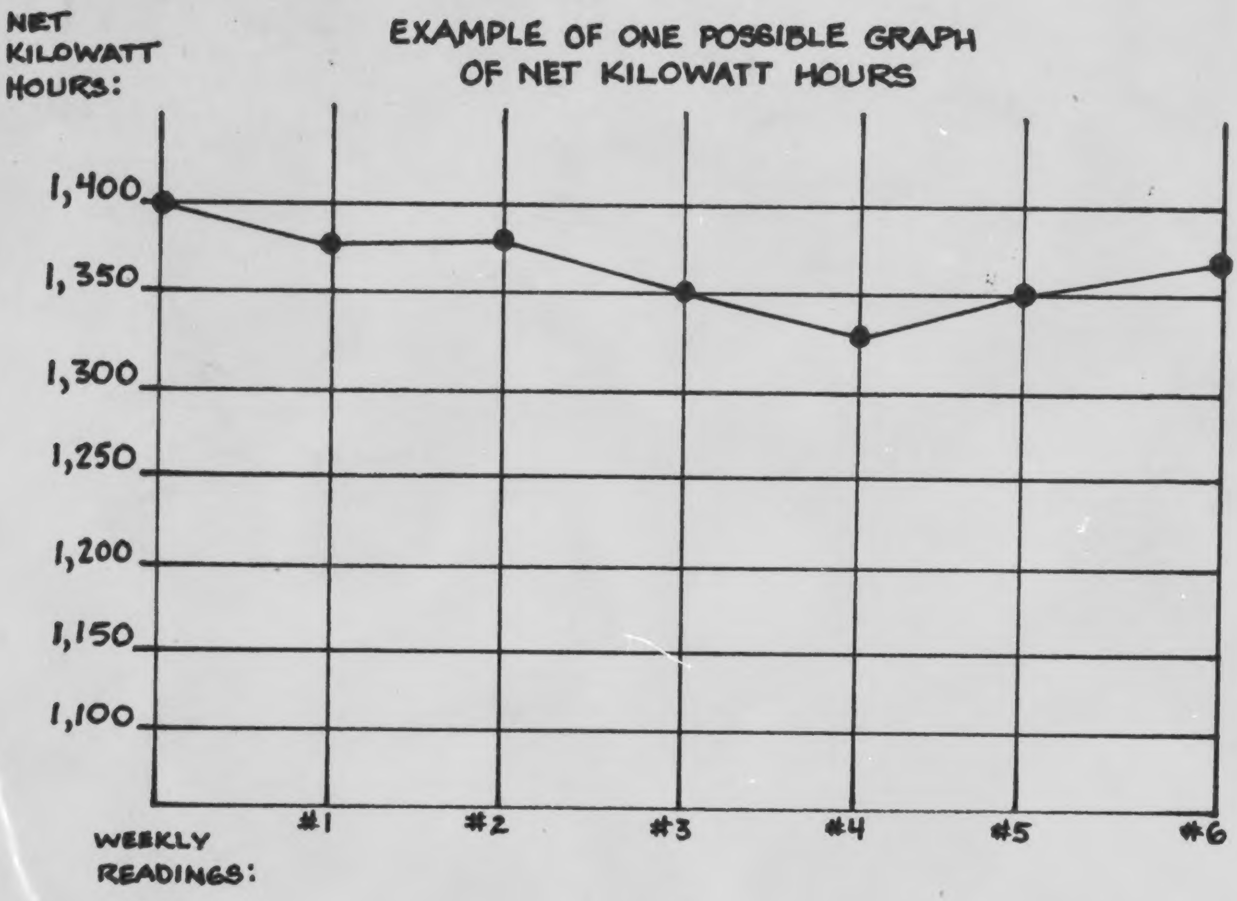
In a classroom setting, a teacher can use a cardboard model of an electricity meter to demonstrate how to read the meter. One reads the four or five dials from the left to the right. Regardless of the fact that some of the dials move in opposing directions, one always reads the smaller figure when the needles are between two numbers. If the needle of a dial appears to be directly over a number, then the reader should look at the dial to the right to see whether its needle has passed zero. If the needle has not passed zero, then the reader should record the lower number on the left-hand dial. However, if the dial to the right has passed zero, then the reader should record the number directly under the pointer on the left-hand dial. The examples below illustrate this procedure.



READING - 4882
(PREVIOUS)



READING - 4982
(PRESENT)



EXAMPLE OF ONE POSSIBLE GRAPH OF NET KILOWATT HOURS

The class average kilowatt-hour charts or the charts individually kept by students will show peaks and valleys in graphic form. For example, the charts may go down for a few weeks and then rise. Questions could center on why the electrical consumption has risen or fallen. Has the weather been warmer, leading to a reduction in use of the electrical furnaces? Or has the weather been so warm that air conditioners are being used, leading to increased electrical consumption?

Once charting begins and families try to reduce their electrical use, there still may not be a significant reduction in kilowatt-hours in every case. Lights, can-openers, radios and other small appliances do not consume as much electricity as electric hot water heaters (approximately 400 kilowatts/month), air conditioning units (approximately 116 kilowatts/month) or electrical furnaces (1,600 kilowatts/winter month). Thus, if someone turns off lights but not the air conditioners, very little drop will be seen in the kilowatt-hour consumption. The instructor should realize that electrical consumption may not always decline and emphasize the different power rates of various appliances in class and discuss how that might effect the data charted. A chart pinpointing average kilowatt-hour electrical consumption per appliance is provided. (See page 131.)

Variations on the Same Theme

The instructor could ask a local power company to supply hourly electrical consumption data for a large geographical region for a week. The class could then graph and analyze the regional electrical consumption in the same manner as they have for their home or school. Does the regional electrical consumption have daily peaks in the morning, noon, and the evening? Why? Does it have anything to do with breakfast, lunch, and dinner? Does the electrical consumption increase on the weekends? How did the weather affect electrical consumption?

References

Award Winning Energy Education Activities for Elementary and High School Teachers by Helen Carey (ed.), U.S. Department of Energy, ERHQ-0011. Available from Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Includes a section on analyzing kilowatt electrical consumption at home by students.

Kilowatt Counter by Gil Friend and David Morris, 1975, (36 pages). Available from Alternative Sources of Energy, Rt. 2, Box 90A, Milaca, MN 56353, $2.00. A very good basic description of what energy is and how it is measured.

350 Ways to Save Energy (and Money) in Your Home and Car by Henry R. Spies, et al., 1974 (198 pages). Available from Crown Publishers, Inc., 419 Park Avenue, South, New York, NY 10016. A section of the book addresses behavior alterations to conserve energy in the home.

POWER AND MONTHLY KWH CONSUMPTION
VARIOUS HOME APPLIANCES

APPLIANCES	POWER IN WATTS	TIME USED PER MO. IN HRS.	TOTAL KWH PER MO.
Air Conditioner (window)	1,566	74	116
Blanket, electric	177	73	13
Blender	350	1.5	0.5
Broiler	1,436	6	8.5
Clothes Dryer (electric)	4,856	18	86
Clothes Dryer (gas)	325	18	6.0
Coffee Pot	894	10	9
Dishwasher	1,200	25	30
Drill (1/4 in. elec.)	250	2	.5
Fan (attic)	370	65	24
Freezer (15 cu. ft.)	340	290	100
Freezer (15 cu. ft.) frostless	440	330	145
Frying Pan	1,196	12	15
Garbage Disposal	445	6	3
Heat, electric baseboard ave. size home	10,000	160	1,600
Iron	1,088	11	12
Light Bulb, 75-watt	75	120	9
Light Bulb, 40-watt	40	120	4.8
Light Bulb, 25-watt	25	120	3
Oil Burner, 1/8 hp	250	64	16
Range	12,200	8	98
Record Player (tube)	150	50	7.5
Record Player (solid st.)	60	50	3
Refrigerator-Freezer (14 cu. ft.	326	290	95
Refrigerator-Freezer (14 cu. ft.) frostless	615	250	152
Skill Saw	1,000	6	6
Sun Lamp	279	5.4	1.5
Television (B&W)	237	110	25
Television (color)	332	125	42
Toaster	1,146	2.6	3
Typewriter	30	15	45
Vacuum Cleaner	630	6.4	4
Washing Machine (auto)	512	15	9
Washing Machine (ringer)	275	17.6	4
Water Heater	4,474	89	400
Water Pump	460	44	20

Adapted in part from a chart appearing in "Electric Power From the Wind"by Henry Clews, published in Producing Your Own Power, ed. by Carol Hupping Stoner, Rodale Press, 1974 (see Reference section after Bio-Gas Generator).

12. SOLAR FOOD DEHYDRATOR

Complexity Level: II

Who Can Do It?

This activity can be conducted at school or at home. The carpentry skills required for the activity would be suitable for a vo-tech class. However, anyone with basic woodworking knowledge should not find the solar food dehydrator difficult to build. Grades 9-12, community college, and continuing adult education courses can use this activity for demonstration purposes. Adults wishing to preserve food at home will find a utilitarian value in this activity.

Material Costs

Around $35.00, the majority of the cost being for lumber. Recycled lumber can reduce costs considerably.

Time to Completion

Around 16 hours for one individual. This project can be completed in 8 hours when more than one person is involved in the construction.

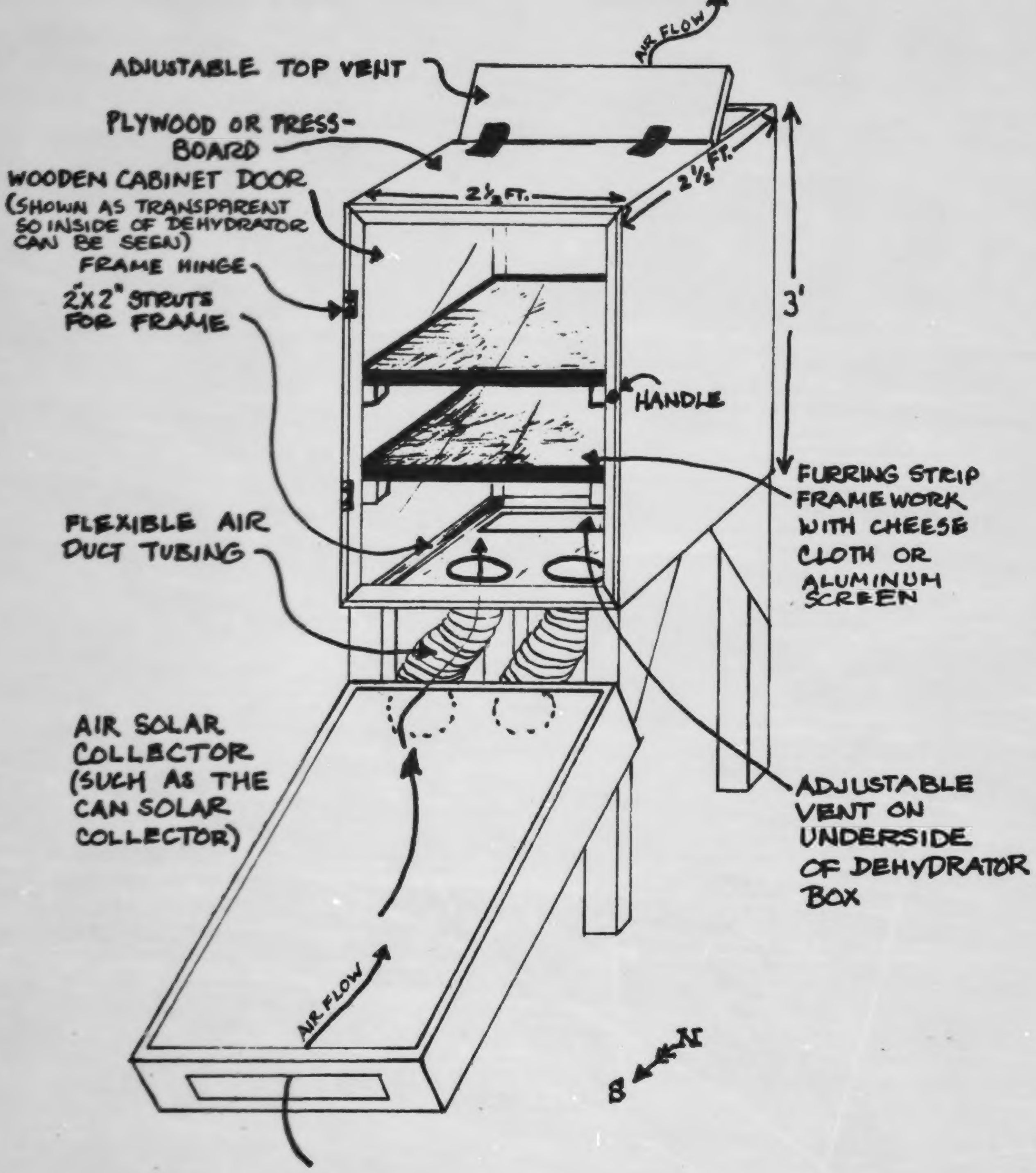
Advantages

Once completed, a sizable quantity of fruits and vegetables can be dried and preserved. The longevity of vitamins in food stored under various conditions (e.g., dry storage versus canned food), evaporation as a function of surface area to volume of food slices and of heat and air flow could all be topics discussed in class in reference to a food dehydrator.

Procedure

The solar food dehydrator is essentially a four-sided plywood box. The top of the box should have an adjustable vent/flap to regulate air flow through the dehydrator. Adjustable air vents should also be placed at the base or bottom of the box. An air solar collector similar to the can collector (No. 2) is attached via air ducting to the base of the dehydrator. Plastic air ducting used for

SOLAR FOOD DEHYDRATOR


AIR FLOW
ADJUSTABLE TOP VENT
PLYWOOD OR PRESS-BOARD
WOODEN CABINET DOOR (SHOWN AS TRANSPARENT SO INSIDE OF DEHYDRATOR CAN BE SEEN)
FRAME HINGE
2"X2" STRUTS FOR FRAME
2½ FT.
2½ FT.
3'
HANDLE
FURRING STRIP FRAMEWORK WITH CHEESE CLOTH OR ALUMINUM SCREEN
FLEXIBLE AIR DUCT TUBING
AIR SOLAR COLLECTOR (SUCH AS THE CAN SOLAR COLLECTOR)
ADJUSTABLE VENT ON UNDERSIDE OF DEHYDRATOR BOX
AIR FLOW
S
N

clothes dryers could serve this purpose well. Although not illustrated, one could connect small air fans to the ducting to increase the efficiency of air flow through the dehydrator.

Hot air generated in the solar collector is vented into the base of the box where it rises and escapes through air vents at the top of the box. Exterior grade plywood is perhaps the best material for the box's construction, although pressboard could be used. An internal wood frame of 2 inches x 2 inches or 2 inches x 4 inches should be built first, upon which the wood sheeting is nailed. The actual dimensions of the box can vary depending on available construction materials and the amount of use envisioned for the dehydrator. Small wood blocks are nailed to the 2-inch-x-2-inch framework. Cheese cloth screens are constructed where cheese cloth is stretched over a framework made of 1-inch-x-1-inch furring strips. Another alternative would be to use aluminum screening rather than cheese cloth. Steel screen would rust, however. These screen frames are then set upon the wooden blocks. Slices of food (apples, oranges) are dried on the cheese cloth or aluminum screens. The approximate dimensions are shown in the illustration.

Variations on the Same Theme

Other functional solar food dehydrator designs have been built and tested. Before an instructor begins building the food dehydrator as described, he or she may want to review a number of the references listed below.

References

Dry It - You'll Like It by G. MacManiman, 1973 (64 pages). Available from Living Foods Dehydrators, P.O. Box 546, Fall City, WA 98024, $3.95.

How to Build a Solar Crop Drier by the New Mexico Solar Energy Association, 1976 (10 pages). Available from New Mexico Solar Energy Association, P.O. Box 2004, Santa Fe, NM 87501.

Samuel Kaymen, Agricultural Coordinator, NNECAT, Durham, NH 03824. If you would like more detailed information regarding new, innovative approaches to education projects in agriculture, contact Mr. Kaymen.

Solar Energized Food Dehydrator by Solar Survival, Cherry Hill Road, Harrisville, NH 03450, $5.00.

Survey of Solar Agricultural Driers by Brace Research Institute, 1975. Available from Brace Research Institute, MacDonald College of McGill University, Ste. Anne de Bellevue, Quebec, Canada, $5.00.

13. RADIO AND TELEVISION PROGRAMMING

Complexity Level: II or III

Who Can Do It?

Energy-related educational programming for radio and television can be developed by CAAs, educational institutions, or both. The community at large would benefit from these activities.

Material Costs

Should be minimal if a cooperative arrangement is developed with the radio or television station. Stations may absorb all of the production costs if they consider airing the programs "in the public interest."

Advantages

Television and radio are powerful media which can reach thousands of viewers and listeners, including potential students. The amount and quality of information on energy issues via television and radio has been rather sparse. Any informative programs developed by students would have a reasonable chance of being accepted by the broadcast stations, as a service to the public and the station. Students can gain skills in public relations, investigative reporting, media production and energy problems in general through this kind of program development.

Procedure

The easiest public service activity to develop would be with a radio station. The station manager should be contacted to discover the kind of public service programming preferred at that radio station. Most likely, a question-and-answer show involving elected officials and citizens will be the preferred basic format. If that is the case, a college class, for example, could develop a list of people they might want to interview and a list of questions they would like to ask. For example, representatives from the state's energy programs might be approached with a set of questions relating to energy conservation. The interviewers would be selected from the class members to conduct the interview on the air.

The chances would be fairly good that the radio station would allow this kind of programming if it appeared that the format for the show were well organized. Of course, background reading and research by class members into energy conservation and production topics would be necessary to prepare for such an endeavor.

Local television stations often run special topics serially throughout a 1-week period, devoting 1 or 2 minutes each evening during their news broadcasts to subjects such as crime, flooding, etc. A class or CAA could develop a tentative program for the television station and approach the station news director with the idea. The major topic might be "how to conserve energy at home" and the 5-weekday sequence might include "how to insulate the attic," "cleaning the furnace air filter," "turning down the water heater thermostat," "how to make your own storm windows," and "how to make your own insulative drapes." Depending on the subject matter, students could undertake the basic literature review for the broadcaster (compiling facts and figures), and could contact potential interviewees. Depending on the interest and receptivity of the television station, 1/2-hour public service programs could be approached in the same manner, with a class or CAA cooperatively working together to create and produce an energy-related program.

Variations on the Same Theme

The actual production of radio or television programs is also possible by working with a community college or university which has a media department. Often media curriculum requirements include development of media programs for class credit. For example, students may be asked to produce 30-second, broadcast-quality video spots for television. Or they may be required to develop a tape recording of a spot or show that could be aired over the radio. A CAA should exploit these resources by presenting ideas for one or more media programs to instructors and students.

There are a number of other exciting options for energy-related educational programming. For example, using a tape recorder, students could poll "the man on the street" on various energy issues. An edited audio tape could be broadcast later over the radio. In cooperation with a television station, "how-to" shows could be produced (e.g., "how to build a solar collector") providing step-by-step visuals of the construction process. Information on construction costs; economies of solar installations, including payback times; and where more information on solar energy could be obtained might also be incorporated into such a program. Students could examine ways to change local building codes to make them more receptive for solar and then present the proposed changes to the building code to officials and the public through media.

Plays and perhaps comedy skits could also be broadcast over television. High school or junior college dramatics classes and clubs could be invited to develop original productions, and CAAs could work as the liaison between schools and the television stations.

Slide shows and films developed by high school or college media classes could be broadcast as well by television stations since many stations have the capability to transfer both 35-mm slides and 16-mm film to the video tape they normally use. However, details would have to be discussed with the station concerning content and length of the shows as well as the acceptability by the station to undertake such a project.

References

Children as Film Makers by John Lidstone and Don McIntosh, 1970 (111 pages). Available from Van Nostrand Reinhold Company, $7.95.

Educational Communications and Technology: An Introduction for Teachers (Second Edition) by John B. Haney and Eldon J. Ullmer, 1975 (195 pages). Available from Wm. C. Brown Company Publishers, $5.20. Includes helpful appendices as well as hands-on television/radio production methods.

Good Frames and Bad: A Grammar of Frame Writing by Susan Meyer Markle, 1969. Available from John Wiley & Sons, Inc., $9.25 (cloth), $5.95 (paper).

Instructional Design: A Plan for Unit and Course Development by Jerrold E. Kemp, 1971 (130 pages). Available from Fearon Publishers, $2.50.

Teaching through Radio and Television by William B. Levenson and Edward Stasheff, 1969 (560 pages). Available from Greenwood Publishing Corporation, $18.00.

14. BIO-GAS GENERATOR

Complexity Level: III

Who Can Do It?

This activity could be conducted either at school or at home. Enough methane can be generated with the digester described to cook a one-course meal per day. Basic soldering skill is required for the digester's construction. Since the methane generated by the digester is flammable and, if accidently mixed with air, is explosive, safety precautions need to be taken at all times. Supervision by teachers or parents is urgently recommended for this activity.

Material Costs

Total costs should not exceed $25.00. Used 55-gallon drums can often be purchased for around $10-15, and the remaining parts (gate valve, galvanized piping, T-pipe section, hose, and tire inner tube) should not exceed $10 if purchased. Recycled parts will lower costs, of course.

Time to Completion

This digester should take approximately 4 hours to construct, assuming all the parts are available.

Advantages

Although relatively small, this methane digester has been used by a number of individuals for their daily cooking in Third World countries. Methane digesters of this construction have been displayed at county fairs and have attracted many sight-seers. Thus, these digesters can be effective demonstration projects even outside of the classroom. In school, a digester could be a project of a chemistry or general science class. Waste disposal systems, anaerobic digestion, organic and inorganic nutrients resulting from decomposition, gas formation and heat content of gases could all be subjects discussed in class while the bio-gas generator is being built and tested.

Procedure

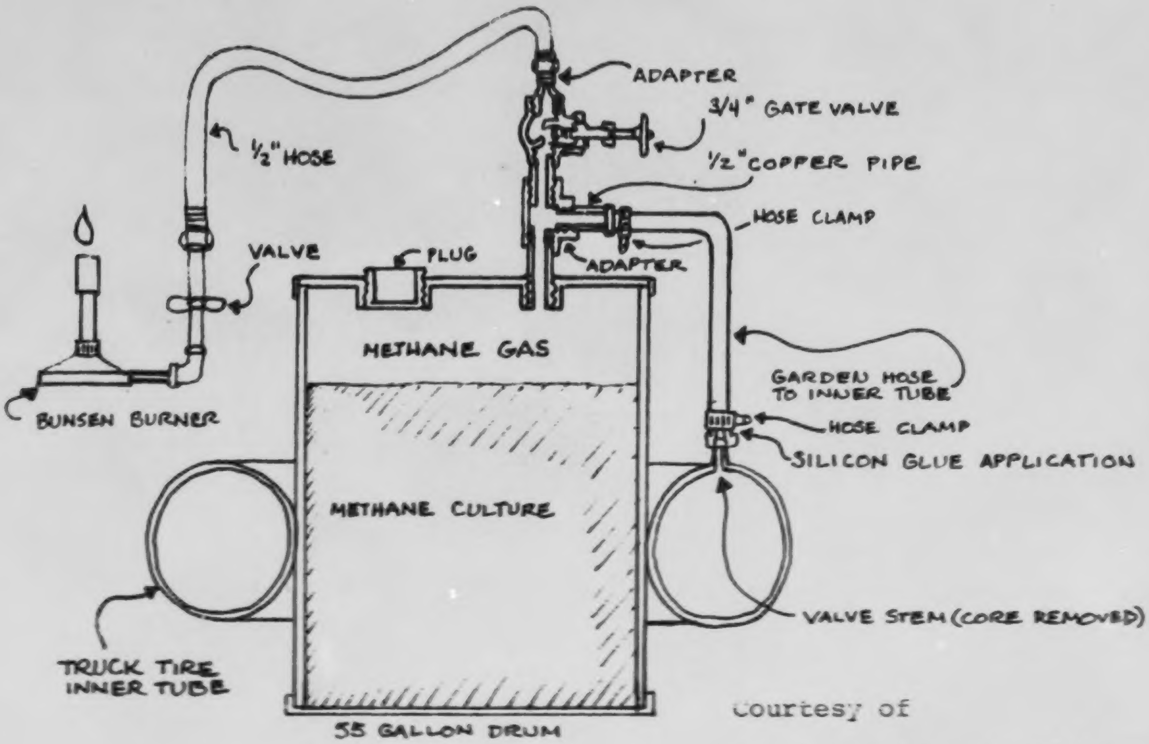
Review the accompanying illustration for details. It can be seen that there are three basic parts to the digester: (1) a 55-gallon drum to hold the manure slurry; (2) a tire for storing the bio-gas (methane); and (3) a gate valve for regulating the gas flow. The basic function of the digester is to contain a manure slurry in the absence of oxygen. This allows the anaerobic digestion of the manure to occur. The bacteria which decompose the manure slurry produce methane gas as a by-product. The methane gas (the basic component of natural gas) is combustible and can be used for cooking, heating, and driving internal combustion engines. It is important to re-emphasize that the decomposition of the manure slurry must occur in the absence of oxygen. Otherwise, methane will not be produced. Therefore, the digester must be airtight to be functional.

The 55-gallon drum used for this methane digester should have a screw plug or "bong." The plug allows the digester to be periodically refilled with a manure slurry or emptied of a spent slurry. The galvanized steel piping and gate valve, as illustrated, are soldered to the 55-gallon drum as one would solder home water piping. Mechanical "how-to" books can provide details on soldering techniques. An airtight seal can be checked by forcing compressed air into the digester once all the soldering is completed. A tire inner tube is used in this digester design to store the methane gas. The hose connecting the tube to the galvanized pipe can be sealed to the tire tube with silicon glue. Referring to the illustration, it can be seen that when the gate valve is closed, the methane gas fills the inner tube. And when the gate valve is opened, the compressed methane gas is then forced out to the burner. A Bunsen burner can be used (check the chemistry department), but the burner's holes need to be enlarged because of the low-pressure methane. A Coleman stove can also be used, but once again the adapter on the stove which mixes the air with the gas must be adjusted to allow more air to mix with the methane gas.

Once the digester is operational, about 10 cubic feet of methane should be produced per day. This is enough gas to run the burner for 1/2 hour each day. The digester should continue to produce methane for a month with one charge of liquefied manure.

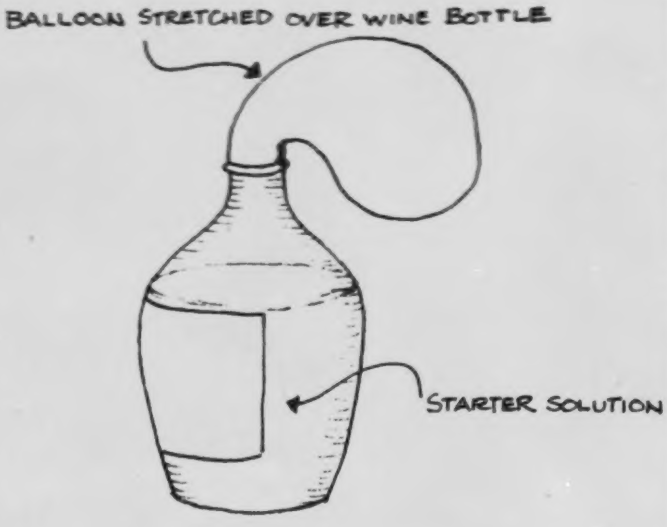
CAUTION: Methane is very volatile when mixed with air, so extreme care must be taken to purge the entire system of air before attempting to burn the methane.

METHANE DIGESTER

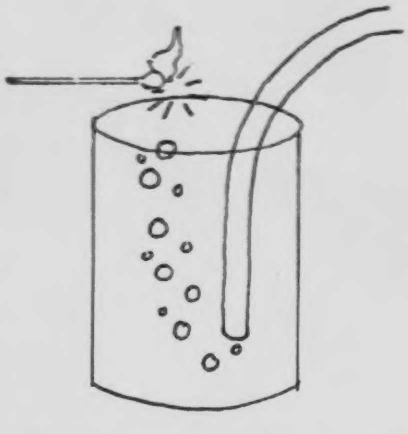


Courtesy of

Popular Science Magazine


BALLOON STRETCHED OVER WINE BOTTLE
STARTER SOLUTION

STARTER SOLUTION



TESTING METHANE GAS

Once the digester begins generating gas, the methane will contain some oxygen originally contained in the tank. Therefore, for the first few days, this methane containing oxygen should be allowed to escape. After about 3 days, the gas can be checked by bubbling it through water and igniting the gas bubbles with a match (see illustration). If the gas burns slowly, it is ready for use. However, if it ignites with a popping sound, the digester must be purged a day or two longer.

There are two factors which will influence to a very large extent the amount of methane gas generated. The first is the temperature of the manure slurry, which should be maintained at 95°F for optimum results. The second factor is the carbon-to-nitrogen ratio of the manure slurry. A detailed explanation of the carbon-to-nitrogen ratio can be found in Other Homes and Garbage and Producing Your Own Power listed in the references.

Basically stated, the anaerobic bacteria use up the carbon in the organic matter they are decomposing about 30 times faster than they use up the nitrogen. So a manure slurry with approximately 30 times as much carbon versus nitrogen will permit digestion to proceed at an optimum rate. This carbon-to-nitrogen ratio of 30:1 can be achieved by mixing organic matter high in carbon but low in nitrogen (grass clippings, leaves) with organic matter low in carbon but high in nitrogen (fresh chicken, horse, or cow manure). For details, review the references.

Achieving the optimum population of anaerobic bacteria in the manure slurry can take up to 8 weeks of culturation time if one is beginning from scratch. To hasten methane generation, a "starter" solution is usually added to a methane digester which has just been filled with a fresh slurry. The "starter" solution is simply a small amount of manure slurry, about 5 gallons, already rich in methane producing bacteria.

A series of large wine or water cooler bottles with small necks can be used as containers for the "starter" solution. A manure slurry is placed in the bottles, and a large balloon is placed over the mouths of the bottles (see illustration). The slurry is allowed to sit for 6 to 8 weeks. As gas is generated, the balloons will expand. If one has planned it properly, the "starter" solution will be generating methane just about the time the digester construction has been completed. By inoculating the manure slurry with the "starter" solution, the digester should begin to generate methane within 4 days.

References

"Larry J. Romesberg Cooks with Bio-Gas" from Adventures in Alternative Energy, Popular Science, December, 1975. 380 Madison Avenue, New York, NY 10017.

Anaerobic Digestion of Dairy Cow Manure at the State Reformatory Honor Farm by Ecotope Group, 1975. Available from Ecotope Group, 747 - 16th Avenue East, Seattle, WA 98112, $8.00.

Other Homes and Garbage: Designs for Self-Sufficient Living by Jim Leckie, Gil Masters, Harry Whitehouse, and Lily Young, 1975. Available from Sierra Club Books, 530 Bush Street, San Francisco, CA 94108, $9.95.

Practical Building of Methane Power Plants for Rural Energy Independence by L. John Fry. Available from Undercurrents Books, 11 Shadewell, Uley, Dursley; Gloucestershire, England, $12.00.

Producing Your Own Power by Carol Hupping Stoner (ed.), 1975. Available from Rodale Press, 33 East Minor, Emmaus, PA 10849, $3.95. Contains a chapter on methane digester operation.

15. SOLAR HEATED GREENHOUSE

Complexity Level: III

Who Can Do It?

This activity can be an exciting class project and a worthwhile solar heating and food production addition to the home. If undertaken by a class and/or CAA, it will often attract community interest through the news media. Some carpentry skill is involved and it would be advisable to contact someone early in the activities development with woodworking experience.

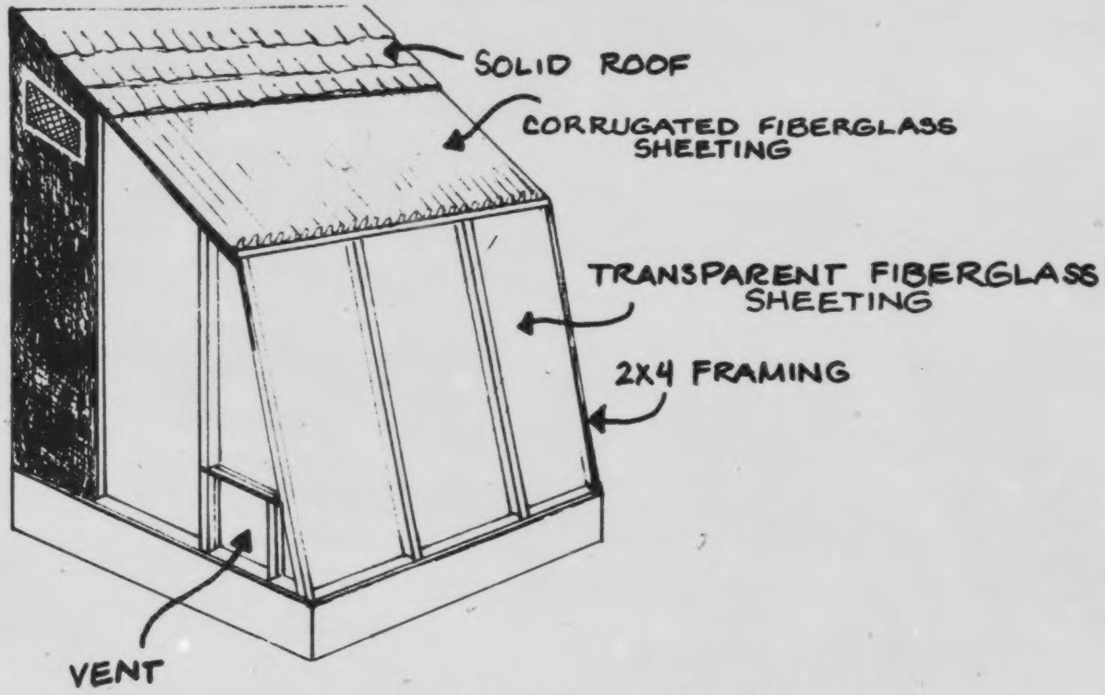
Material Costs

Costs range from $5.00 per square foot to $7.00 per square foot of greenhouse floor area. Thus, a 10-feet-long-by-10-feet-wide greenhouse (100 square feet) will cost between $500 and $700 to construct. Although this is somewhat expensive, the greenhouse can in some cases provide supplementary heat to a home. Basically, a greenhouse is a very large solar collector, and a lean-to greenhouse can be designed so that solar heated air generated in the greenhouse is vented into the home. The cost of a hand-built greenhouse is roughly equivalent to that of a hand-built solar collector on a square foot basis. That is, a hand-built solar collector designed to be durable (lifetime - 20 years) will cost between $5-7 per square foot as will a greenhouse ($5-7 per square foot of enclosed space).

Time to Completion

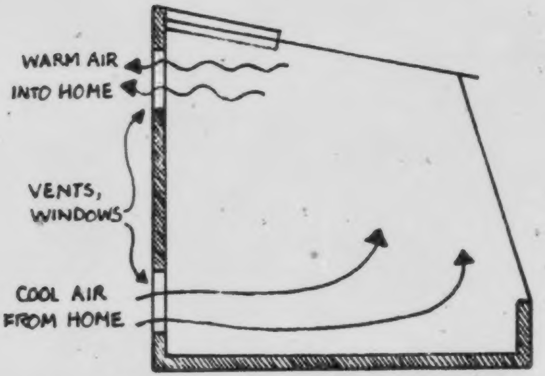
If the activity is properly organized and the construction tasks are well defined, it is possible to construct a 100-square-foot greenhouse in two weekends. However, it would be wise to plan for such an activity over a 4- to 5-month time span. Planning the structural design, purchasing the materials, and finding the proper tools and equipment all take time. For example, if fiberglass is ordered as the glazing/covering for the greenhouse, it can take up to 1 month or more to receive the shipment. Unexpected delays are a common occurrence in a project of this size. Be flexible in your timetable.

SOLAR HEATED GREENHOUSE

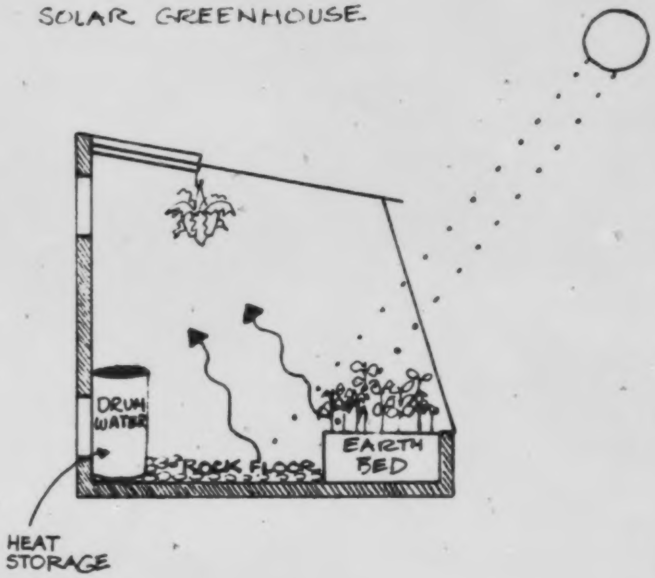

SOLID ROOF
CORRUGATED FIBERGLASS SHEETING
TRANSPARENT FIBERGLASS SHEETING
2X4 FRAMING
VENT

VIEW FROM SOUTH

GREENHOUSE AS SOLAR COLLECTOR



THERMAL STORAGE IN A SOLAR GREENHOUSE



Advantages

As an environment to grow vegetables, a solar greenhouse can serve as a classroom setting for various biological experiments such as measuring plant growth versus light intensity. Also, cool weather crops can usually be grown throughout the winter in a solar greenhouse without any supplemental heating of the structure.

Procedure

There are a number of descriptive books and booklets which are now available on solar greenhouse design and construction. Several of these texts are included in the references section.

Before the actual design and construction of the greenhouse, some preliminary planning steps could be initiated. Students can be asked to build their own models for a greenhouse out of cardboard and clear plastic food wrap. The first model might be a cardboard box with a window in one side. Later, more sophisticated cardboard models could be built as complex design concepts are introduced into class discussions.

The principles of heat flow, heat equilibrium, insulation, and heat conductivity outlined in the shoe-box solar collector project (No. 1) and the testing insulative materials project (No. 5) would serve as a sound fundamental beginning for the future planning of the solar greenhouse. The models can also be discussed in terms of heat loss areas, solar heat gain areas, ways of shading the model (deciduous plants, eaves), heat storage systems (water, rocks, earth), the compass direction the greenhouse is facing (north, south), ways of venting hot air from the greenhouse into a house, ways of insulating the greenhouse glazing at night, the surface area of the greenhouse versus the volume it encloses, and material costs and durability. Through the use of models and class evaluations of the different designs, the students should be able to suggest the best design for the solar greenhouse.

Once a general design has been settled on, the students can then be asked to begin design of the wood framework for the greenhouse, deciding as to the materials they need and perhaps even ordering those materials. It would be helpful to bring a vo-tech instructor or an individual with carpentry experience into the process to provide suggestions and guide the students as they plan the greenhouse construction.

Variations on the Same Theme

On-site visits of solar greenhouses that have already been constructed would be a very valuable learning experience for a class that is about to build their own greenhouse.

After the greenhouse is completed, class records of the thermal characteristics of the greenhouse are an important extension of the greenhouse as an energy education project. For example, air temperature records in the greenhouse at various heights should prove that hot air rises and stratifies. Temperature measurements of the walls, floor, and glazing should indicate which areas are losing heat more rapidly. If rocks or water are used for heat storage, a temperature record of their performance over time should indicate how much heat is stored or emitted. (This would be subject matter for a physics course, or the physics teacher could be invited to the class to provide advice).

A number of educational institutions have built solar greenhouses successfully and have involved children at the sixth-grade level in the project, proving both the unskilled and semi-skilled can be involved in a project of this complexity.

References

An Attached Solar Greenhouse by Bill Yanda and Susan Yanda. Available from Lightning Tree Press, Santa Fe, NM 87501.

Community Action of Laramie County, Wyoming has a 15-minute slide show with audio available on how a solar greenhouse was organized and built. Interviews with participants are included in the audio portion. The slide show can be rented for $30.00. Contact Mr. Gary Garber for more information at: Community Action of Laramie County, 1603 Central, Number 400, Cheyenne, WY 82001 (307/635-1909).

Low-Cost, Energy-Efficient Shelter for the Owner and Builder by Eugene Eccli (ed.), 1976 (600 pages), Rodale Press, Emmaus, PA 18049, $7.95. See chapter on solar greenhouses by Ronald Alward.

Solar Heated Greenhouses (special edition) by Alternative Sources of Energy (Feb/March 1979), (56 pages), Rt. 2, Box 90A, Milaca, MN 56353, $2.00. Extremely informative edition of solar greenhouse design and development.

Solar Greenhouse Digest, Inc., P.O. Box 3218, Kingman, AZ 86401, $7.00 per year. Periodical on greenhouse design.

The Food and Heat Producing Solar Greenhouse by Rick Fisher and Bill Yanda (1977). Available from John Muir Publications, Box 613, Santa Fe, NM 87501, $6.50. Many greenhouses are pictured and described.

The Solar Greenhouse Book by James C. McCullah (ed.), 1978. Available from Rodale Press, Emmaus, PA 18049, $8.95. Very comprehensive book discussing heat gain, heat storage, orientation of greenhouse, etc.

The Survival Greenhouse by James De Korne, 1975. Available from The Walden Foundation, El Rito, MN. A pit or sunken greenhouse design.

Vocational Region 10 Solar Greenhouse: A Resource Booklet for Vocational Educators by the Maine Audobon Society, 1979. Available from Maine Audubon Society, 118 Old Route One, Falmouth, ME 04105, $4.50. A description of a vocational education project where a solar-heated greenhouse was designed and constructed by students.

16. MOBILE "ENERGY DEMO" VAN

Complexity Level: III

Who Can Do It?

This activity could be undertaken by a CAA and/or a county or state school district. Although the development of a mobile energy demonstration van would not be a difficult project, it would require capital, a long-range commitment, and full-time coordination elements more commonly found in a large organization. One possible alternative would be to organize such an activity on a school district level utilizing the administrative resources of that district. In that manner, 10 to 20 schools might be involved in the development and implementation of the demo van.

Material Costs

The activity as presently conceived would entail outfitting a van with a variety of energy conservation and appropriate technology devices. Hand-built solar collectors, solar cookers, examples of insulation, insulative drapes, and well-designed storm windows could all be incorporated as demonstrations on the van. The van could travel to classes, schools, colleges, fairs, workshops, conferences, shopping centers, etc.

If a used vehicle could be purchased at $800, the outfitting of the van may cost another $300 to $500, depending on the number of energy-related demonstrations incorporated into it. Occasionally, an auto dealer will sell a van at or below cost for this kind of use in exchange for public service publicity. Labor for the van's operation must also be accounted for.

Advantages

The van would allow a very large geographical area to be canvassed. For example, it might be possible to visit every school within a school district, given the proper organizational support. A broad spectrum of people from elementary pupils to adult community members could be reached in an aggressive outreach program (e.g., the van parked at community shopping centers). In short, the mobility of the van would allow wide access to energy "demo" projects many viewers would normally not have the opportunity to see.

Procedure

Development of a general educational theme for the van, such as "energy conservation at home," would be a logical first step. Once a theme is chosen, a list of projects that would fit the theme could be selected. The "demo" projects finally incorporated into the van would, of course, have to be adapted to the physical dimensions of the van.

An educational package of activities could be developed that would be presented by the operators of the van when they visited the schools. For example, if one of the themes were "solar energy," many of the solar projects outlined in this guidebook would be suitable for use. Children could see various kinds of solar cookers and learn to make the solar cooker (No. 4). They could see solar collectors and build a can solar collector (No. 2) or the shoe-box hot-box (No. 1). If windmills were incorporated as part of the van, children could also be shown how to make their own pinwheel windmill (No. 7). The possible projects that could be included are only limited by one's imagination.

Variations on the Same Theme

Games, slide shows, and theatrical presentations could all be programmed as activities that would be presented at the school stops made by the van. These activities could be designed for several grade levels. Thus, each set of activities would have optimal educational value.

References

The Bronx Frontier is an organization which runs a traveling nutrition chuck wagon for senior citizens, community organizations and schools. Presentations on balanced nutritional meals are implemented through theatrical skits, slide shows, etc. Although the Bronx Frontier is concerned with health issues related to diet, their kind of mobile educational forum would be adaptable to energy issues. Contact Bronx Frontier, 1080 Leggett Street, Bronx, NY 10455

The New Western Energy Show is a traveling energy demonstration/exhibit similar in approach to the mobile energy van described here. It provides examples of renewable energy technology and methods of energy conservation to schools, communities, and native American tribes. For more information, contact The New Western Energy Show, 435 Stapleton Boulevard, Billings, MT 59101

17. ENERGY "DEMO" HOUSE

Complexity Level: III

Who Can Do It?

A small model house designed to demonstrate energy conservation could be taken to county fairs, set up in schools on a rotating basis, and/or placed in shopping and community centers. The audience for this kind of activity can be the community at large, homeowners, and students.

To construct such a model house would require carpentry skills and could be undertaken by a vo-tech carpentry class or CAA.

Material Costs

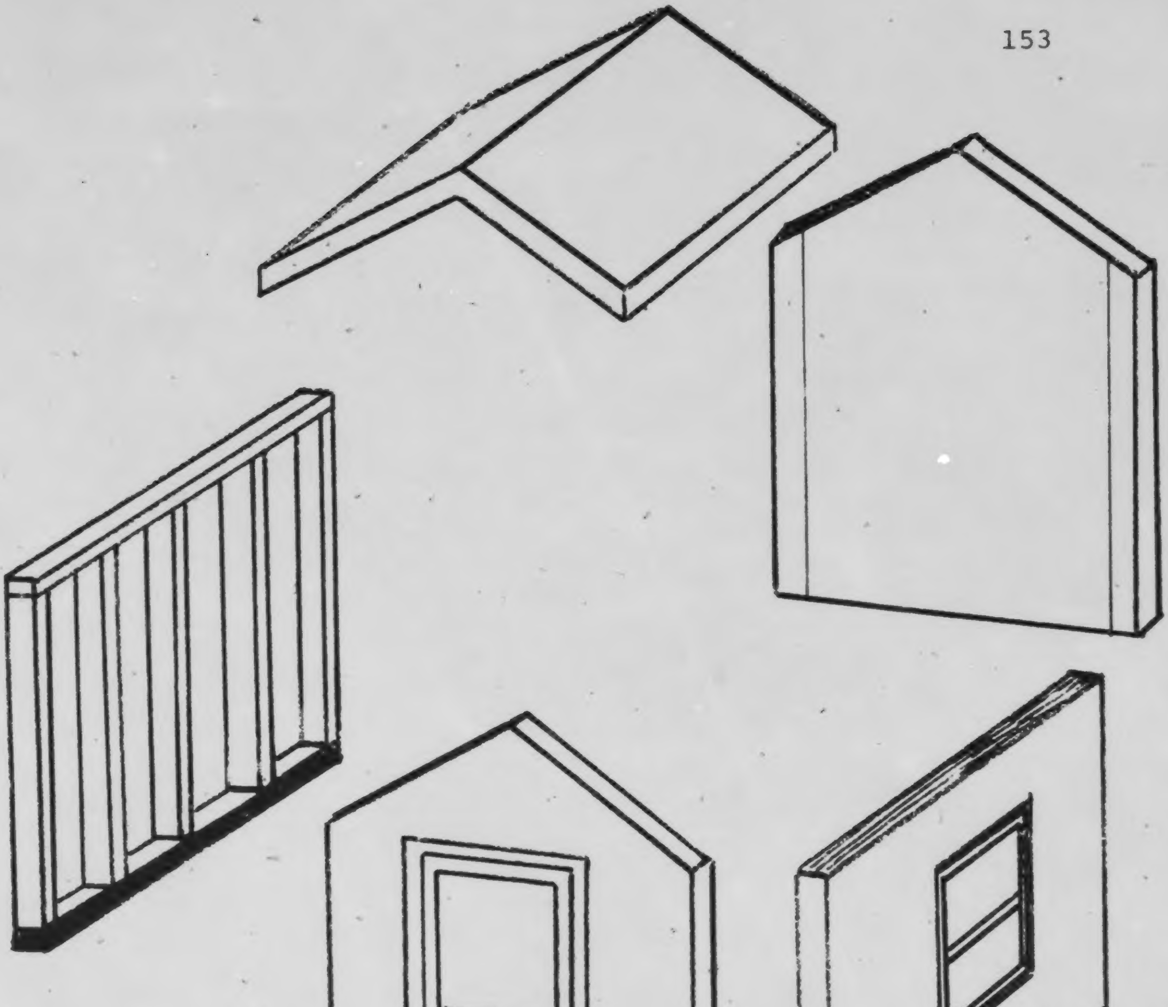
For a model house 6 feet x 6 feet x 8 feet, one could reach costs of between $260 and $400. However, it is possible that materials might be donated or at least sold at cost, if the project were described to the proprietor of a local lumber yard. Final costs are also determined by the number of weatherization and energy conservation features incorporated into the model (e.g., storm windows, storm doors).

Advantages

The model house could be designed to demonstrate energy conservation features not often seen, e.g., insulation behind walls (fiberglass versus other insulation material) or use of vapor barriers. Since people can touch as well as see the various energy conservation features, they are more apt to visualize these energy conservation approaches applied to their own homes.

Procedure

It would be best to design the model house so that it could be disassembled into portable sections. The model should be large enough to allow viewers to walk through it, yet not so large as to be cumbersome when carried from one demonstration site to another. A general schematic has been illustrated where there are five portable sections to the model - four wall sections and the roof. The wall sections could be designed to be bolted together, and the roof would just rest on the interlocking walls.



A high school or vo-tech carpentry class could construct the model house as a class project, where the best suggestions on design and construction offered by the students could be built into the model. The model house's design might be presented as well to drafting, general science, and architectural classes with prizes offered for the best blueprint and/or overall design.

The model house could include examples of passive solar heating or poorly insulated walls versus well-insulated walls, inadequate attic insulation versus adequate attic insulation. Differences in the types of insulation might be demonstrated with corresponding literature on R-values and heat loss. The costs and payback times for each energy conserving feature could also be listed.

Beyond insulation, a number of other energy conserving features could be demonstrated on the model house. Anyone considering building a model house may want to review the references provided to survey the energy conserving devices they could incorporate. Storm windows, caulking and weatherstripping, insulative curtains over the windows (No. 9), and hot-air solar collectors are all possibilities.

Variations on the Same Theme

The Cranston Community Action Agency, Rhode Island, developed a model house as a demonstration in a local energy fair. For more information on its design and use, write: Energy Coordinator, Cranston Community Action Agency, 30 Rolfe Street, Cranston, RI 02910.

References

In the Bank or Up the Chimney? by U.S. Department of Housing and Urban Development, 1976. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, $0.70. GPO Stock No. 023-000-00411-9.

Keeping the Heat In by Office of Energy Conservation, Energy, Mines, and Resources, Canada, 1976. Available from the Book People, 2940 Seventh Street, Berkeley, CA 94710, free.

Keeping Warm for Half the Cost by Phil Townsend and John Colesby, 1975 (91 pages). Available from Conservation Tools and Technology, 143 Maple Road, Surbiton, Surrey KT6 4BH, England, $3.00 (in the U.S.).

18. NEWSPAPER COURSE ON ENERGY CONSERVATION AND SMALL-SCALE ENERGY SYSTEMS

Complexity Level: III

Who Can Do It?

This kind of educational activity might be undertaken as a cooperative venture between a CAA, a community college, a local newspaper, and a consortia of primary and secondary schools, if possible. Arrangements could be made with local educational institutions to provide credit to students enrolled in the course. The reading material for the energy course would be published in segments in the newspaper. Individuals enrolled in the course would only have to attend tests on weekend dates. Of course, many individuals in the community would read the newspaper course even if they did not enroll for credit.

Material Costs

Newspapers would quite likely publish the course material at no charge because it would be considered a public service, community affairs project. However, costs could be incurred in writing the course materials.

A community college in Maryland conducted a newspaper course composed of 13 one-page lectures published in a community newspaper with 15,000 subscribers.* It took 300 person-hours to write the 13 lectures and 300 person-hours to write a study guide for the course. The instructors writing the course material were paid 17 percent of their annual salaries (approximately $3,000) for their labor. Instructors were also paid for a couple of seminars conducted on weekends as well as for tests given. The general cost breakdown was as follows:

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*Although this newspaper course actually covered environmental issues rather than energy issues, the cost of producing the course would be comparable to a similar course in energy issues.

To write 13 one-page lectures	$ 3,000
To write study guide	3,000
To conduct seminars/tests	500
To publish study guides	500
To publish in newspaper (as a public service)	0
Total	$ 7,000

It was assumed that at least 10 percent of the newspaper subscribers read the course but did not enroll in the course. Five hundred individuals enrolled in the course and successfully completed it.

In the aforementioned example, the total costs were $7,000. It should be noted, however, that the majority of the costs, $6,500, were incurred for labor to write the lectures and study guide and to conduct seminars and tests. It is very likely there are opportunities to cut these costs. For example, graduate students enrolled at nearby 4-year colleges, or perhaps a class, could actually write the newspaper course at no cost. The course materials could then be reviewed by the faculty for acceptance by the community college. A journalism course at the high school or college level might undertake the writing of the course as a project, reducing the labor costs considerably. If the course were conducted as a continuing adult education course (non-credit), the red tape involved in its acceptance by the college would be minimal.

Time to Completion

The actual development of the previously mentioned 13-lecture course took about 6 months to write. This time span could be reduced, however, if the number of lectures were reduced and/or a larger staff than the original six part-time writers were used.

Advantages

Community members who cannot attend daytime course seminars because of job conflicts could register for such a course. As mentioned earlier, many newspaper subscribers will read the course material although they elect not to take it for credit. The course can be repeated within the educational institution in subsequent years utilizing surplus newspaper copies of the course obtained during the original publication.

Procedure

An organization such as a CAA which is external to the community college or similar educational institution should probably approach the chairman of the institution's science department and any instructors teaching courses on energy. The editors of community newspapers in which the course might be published should be contacted early in the planning stages as well. Should money be available to pay instructors to write the course materials, there would be a good possibility that the educational institution would accept the idea. However, even without any sizable amount of funds, instructors could be approached with the idea that such a newspaper course be undertaken as a class project. Listed below are some possible topics for a newspaper course:

1. the value of insulation and payback periods;
2. differences between window designs in conserving energy;
3. car maintenance and energy conservation;
4. energy conserving behaviors at home;
5. the methane energy alternative;
6. gardening at home to indirectly conserve energy;
7. passive solar heated homes;
8. active solar heated homes;
9. zoning laws, building codes, and energy conservation;
10. wood stoves and the wood energy alternative;
11. wind energy and windmills;
12. sysgems which integrate solar, wind, methane, and wood energy alternatives;
13. the national energy supply/demand and things to come;
14. career opportunities in energy;
15. future readings in energy.

Variations on the Same Theme

An alternative to a formal newspaper course for credit could be a weekly series of articles by a journalism class on human interest subjects related to energy. For example, through independent study or as a class project, students could interview backyard experimenters, inventors, and tinkers in energy conservation and production. Stories based on these interviews could be submitted to newspapers for credit.

C. CHECKLIST OF MATERIALS NEEDED FOR EACH PROJECT

1. SHOE-BOX SOLAR HOT-BOX

___ a shoe box or any small cardboard box
___ dark paper or cloth (e.g., black in color)
___ light paper, cloth or aluminum foil (e.g., white)
___ thermometer
___ clear plastic for glazing
___ colored plastic or cellophane (for optional experiment)
___ rubber bands or masking tape

2. CAN SOLAR COLLECTOR

___ coffee cans or large juice cans
___ can opener
___ fiberglass tape
___ approximately 1 pint of flat black paint
___ 3/4" thick exterior grade plywood for collector's back
___ shelving boards for collector's sides
___ storm window or clear plastic for glazing
___ screws, nails
___ caulking (e.g., silicone glue)
___ option: fiberglass or styrofoam insulation
___ optional design: use of chicken wire mesh

3. SOLAR WATER STILL

___ shovel to dig hole
___ plastic liner for hole
___ clear plastic to cover top of hole
___ small can
___ rocks and extra dirt
___ optional approach: wooden box
___ optional design: coat hangers
metal baking tray
masking tape

4. SOLAR COOKER

___ poster board large enough to cut a 22" x 22" square
___ pencil, pen
___ aluminum foil
___ glue
___ small metal dish

___ scissors to cut poster board
___ stapler
___ larger cardboard box
___ rocks or bricks

5. TESTING INSULATIVE MATERIALS

___ test tubes of equal size
___ metal cans of equal size (test tubes should fit entirely in cans if possible)
___ corks or rubber stoppers for test tubes
___ insulative and non-insulative materials: fiberglass insulation, styrofoam chips, sand, aluminum foil, crushed paper
___ laboratory grade thermometer, if possible
___ water brought to a boil (100° C)
___ optional: crushed ice
___ small aquariums

6. ENERGY CONSERVATION POSTER CONTEST

___ poster paper
___ markers, crayons, paint, or any other art supplies

7. SMALL DEMONSTRATION WINDMILLS

(A) ___ a square piece of lightweight paper
___ crayons, pens, or other art supplies
___ a quarter
___ scissors
___ long straight pins
___ long dowel sticks

(B) ___ empty oatmeal box
___ masking tape
___ thumb tacks
___ wood dowel 1/2" in diameter
___ glue
___ heavy cardboard boxes to be cut into strips
___ scissors
___ metal washer with at least a 1/2" diameter hole
___ construction paper
___ string
___ stakes
___ option: use of a wooden table

(C)
___ 2 paper drinking cups
___ plastic drinking straw
___ glue
___ wood dowel or stick
___ straight pin

8. HANDBUILT PLASTIC STORM WINDOW

___ tape measure
___ drill and drill bits
___ miter box
___ vise
___ saw
___ staple gun
___ screws/screwdriver
___ 2" x 2" wood framing to be cut, drilled, and held with screws
___ heavy plastic sheet, clear, 6-10 mils. thick

9. INSULATIVE CURTAINS

___ lightweight curtain liner of insulative material (continuous fiber polyester)
___ tightly woven cloth for curtain
___ sewing machine, thread, needles
___ furring strips (wood)
___ screws
___ option: velcro
___ option: thermometer

10. A SMALL WIND GENERATOR

___ propeller or blade
___ bicycle generator (6 volts, 3 watts)
___ 1" x 1" x 3' long wood piece for pivoting arm
___ IR 18DB7A semi-conductor diode bridge rectifier
___ 6 volt battery
___ 6 volt DC radio or light
___ 2 sq. ft. of wood or metal sheet
___ airplane clamps or wire
___ electrical wire
___ screws/screwdriver
___ bolt and washer
___ drill/drill bits
___ mil-amp meter
___ if needed, metal contact cement (aluminum glue), and rattail file

11. KILOWATT-HOUR CHARTING

___ ruler
___ graph paper
___ option: poster board, art supplies,
scissors for cardboard meter model

12. SOLAR FOOD DEHYDRATOR

___ exterior grade plywood/or pressboard
___ 2" x 4"s
___ 2" x 2"s
___ two sets of hinges
___ flexible air duct tubing
___ aluminum screen or cheesecloth
___ nails/hammer
___ screws/screwdriver
___ materials for solar collector (see project #2)

13. RADIO AND TELEVISION PROGRAMMING

___ optional: portable tape recorder
___ optional: portable 3/4" video camera unit
___ optional: art materials for "story board"

14. BIO-GAS GENERATOR

___ 55 gallon drum (steel)
___ 1/2" diameter copper pipe
___ 3/4" gate valve
___ 1/2" diameter copper pipe adapter
___ 1/2" diameter garden hose
___ 4 airplane clamps for hose
___ truck tire inner tube
___ silicone glue
___ butane soldering torch/soldering flux
___ methane culture slurry components:
fresh manure, water,
finely chopped grass clippings/hay

15. SOLAR HEATED GREENHOUSE

For small models:
___ cardboard boxes
___ plastic sheets
___ masking tape
___ thermometers

For an actual greenhouse: materials will vary with greenhouse size and availability. See the reference *The Food and Heat Producing Solar Greenhouse* by Rick Fisher and Bill Yanda for materials list, and construction steps for a small greenhouse.

16. MOBILE "ENERGY DEMO" VAN

___ van
___ paint
___ plywood for interior
___ nails/hammer
___ screws/screwdriver
___ depending on projects to be demonstrated, materials will vary; review material lists of preceding projects

17. ENERGY "DEMO" HOUSE

___ plywood sheets
___ 2" x 4"s
___ shingles
___ window(s), storm window(s) (see project #8)
___ door(s), storm door(s)
___ nails/hammer
___ screws/screwdriver
___ paint (differing colors)
___ weatherstripping
___ insulation (fiberglass wool, foam)
___ bolts, nuts
___ drill, drill bits
___ option: solar collector (see project #2)
___ option: insulative curtains (see project #9)

18. NEWSPAPER COURSE ON ENERGY CONSERVATION AND SMALL-SCALE SYSTEMS

___ material list not really applicable

SECTION THREE: INFORMATION

CHAPTER VI

PROJECTS CONTACTED

The following energy education projects were contacted between February and September 1978, for a CSA Energy Education Feasibility Study which preceded this Guidebook. Project directors, their assistants, and in some cases CAA directors, very graciously took valuable time to offer their efforts - not only in organizing pioneer programs, but for so willingly sharing ideas. To acknowledge their help, names of the contact persons follow the listing of each project. Readers will understand that, in many cases, these persons have moved on to other locales and projects.

Readers may be interested in two other publications which provide information about local projects. While these projects were not always specific to energy education, they demonstrated small-scale renewable energy systems and sometimes involved young people. The first, entitled "Overview of the Solar Utilization, Economic Development and Employment (SUEDE) Program," is available free from the Office of Energy Programs, Community Services Administration, 1200 19th Street, NW, Washington, DC 20506. In addition, a reasonably up-to-date listing of the nation's 150 most innovative and successful solar projects spanning agriculture, urban, commercial, community, education, financial, housing, industrial, institutional, legislative, low-income, outreach, state, and utility areas of interest, including origin, funding, location, contact persons, addresses, and phone numbers of projects, is available from The Center for Renewable Resources, 1028 Connecticut Avenue, NW, Suite 1100, Washington, DC 20036. Send for Shining Examples: Model Projects Using Renewable Resources, 1980, available at $6.95 a copy plus 15% postage and handling charges; 5% if picked up at the office.

Following the list of names and addresses for projects in this chapter is a matrix which indicates the types of activities undertaken by each project.

REGION I: Connecticut, Maine, Massachusetts,
New Hampshire, Rhode Island, Vermont

1. Cranston Community Action Program
30 Rolfe Street
Cranston, RI 02910
Contact: Adelaide Luber
Dan Waintroob

2. Freeport High School
Freeport ME 04032
Contact: Susan Cashman

3. Portland Area Regional Vocational Center
196 Allen Avenue
Portland, ME 04103
Contact: Steve Gagnon

4. Project EASE - Kingswood Regional High School
P.O. Box 669
Wolfeboro, NH 03894
Contact: David Kinmond

5. Sanford Middle School
2 Main Street
Sanford, ME 04073
Contact: Heather Sadlier

6. Shapleigh Memorial School
MSAD #57
East Waterboro, ME 04030
Contact: Jim Brown

7. Somersworth Regional High School
Memorial Drive
Somersworth, NH 03878
Contact: Bob Creighton

REGION II: New Jersey, New York,
Puerto Rico, Virgin Islands

8. Bethpage Union Free School District
Cherry & Stewart Avenues
Bethpage, NY 11714
Contact: David Lubell

9. Bronx Frontier Development Corporation
1080 Leggett Avenue
Bronx, NY 10474
Contact: Jack Flannigan

10. Council on the Environment of New York City
51 Chambers St., Rm. 228
New York, NY 10007
Contact: Mike Zamm

11. Economic Opportunity Commission of Nassau County
106 Main Street
Hempstead, NY 11550
Contact: Jim McKay
Bob Lawrence

12. Economic Opportunity Program of Chemung County
318 Madison Avenue
Elmira, NY 14901
Contact: Don Goeke

13. New Jersey State Office of Economic Opportunity
P.O. Box 2768
Trenton, NJ 08625
Contact: Thurmond Harrison

14. Sullivan County Commission to Help the Economy
10 Church Street
Liberty, NY 21754
Contact: Ida McRae

REGION III: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia

15. James Buchanan High School
P.O. Box 184
Mercersburg, PA 17236
Contact: Byron Ashburn

REGION IV: Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee

16. Blue Ridge Opportunity Commission
P.O. Box 756
Wilkesboro, NC 28697
Contact: Elizabeth Baker

REGION V: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

17. ACTION CAP
906 Main Street
Evansville, IN 47708
Contact: Eric Dewes

18. Christian Action Ministry
3932 West Madison
Chicago, IL 60624
Contact: Clay Collier

19. Chrysalis Learning Community
1757 West Wilson Street
Chicago, IL 60650
Contact: Michael McConnell

20. Michigan City Fair Housing Committee
724 Franklin Square
Michigan City, IN 46360
Contact: Emmet Wise
Cindy Crockett

21. Social Development Commission
161 West Wisconsin Avenue
Room 7156
Milwaukee, WI 53203
Contact: Freda Mitchem

22. Staples School System Energy Conservation Program
Independent School
District 793
Chicago Ave. & 5th St., NE
Staples, MN 56479
Contact: Ray Gildow

23. Upland Hills Farm School
2575 Indian Lake Road
Oxford, MI 48051
Contact: Phil Moore

24. West Central Wisconsin CAA (WEST CAP)
525 Second Street
Glenwood City, WI 54013
Contact: Dave Hewitt

REGION VI: Arkansas, Louisiana, New Mexico, Oklahoma, Texas

25. Sandoval County Economic Opportunity Commission
1219 Camino del Pueblo
Bernalillo, NM 87004
Contact: Paul Santistevan

REGION VII: Iowa, Kansas, Missouri, Nebraska

26. Blue Valley Community Action (BVCA)
Box 273
Sairbury, NB 68352
Contact: Bill Thomas

27. Greater Omaha Community Action (GOCA)
1805 Harney Street
Omaha, NB 68102
Contact: Jim Termaat

REGION VIII: Colorado, Montana, North Dakota South Dakota, Utah, Wyoming

28. Community Action of
Laramie County, Inc.
1603 Central Street
Bell Building, Suite 400
Cheyenne, WY 82001
Contact: Gary Garber

29. District 4 Human Resources
Development Council
P.O. Box 1058
Havre, MT 59501
Contact: Wayne Cross

30. Lake County Advancement
Opportunities, Inc.
Box 744
Ronan, MT 59864
Contact: Tony Ostaheimer

31. Mountain Open High School
5050 Highway 73
Evergreen, CO 80439
Contact: Jeff Bogart

32. New Western Energy Show
435 Stapleton Building
Billings, MT 59101
Contact: David Nimick

33. Northwest Montana Human Resources Development Council
P.O. Box 1058
Kalispel, MT 59901
Contact: Gary Gobb

34. Reed Junior High School
370 West 4th Street
Loveland, CO 80537
Contact: Jim Weyand
Gary Taylor

35. South East North Dakota
Community Action Agency
670 4th Avenue, North
Fargo, ND 58102
Contact: Sylvia Hove

REGION IX: Arizona, California, Hawaii, Nevada

36. Bay Area Engineering
Societies Committee
for Manpower Training
1333 Broadway
Oakland, CA 94612
Contact: Hattie Carwell

37. Energy Conservation Program,
Community Services Dept. of
San Bernardino County
602 South Tippecanoe Avenue
San Bernardino, CA 92415
Contact: Dina Hunter

38. El Cerrito Recycling Center
El Cerrito, CA 94530
Contact: Joel Wetherill

39. El Dorado Community Action Council
842 Pacific Street
Placerville, CA 95667
Contact: Dennis Rowe

40. Fresno County Economic Opportunity Commission
2100 Tulare St., Rm. 505
Fresno, CA 93271
Contact: Bill Eidson

41. Office of Appropriate Technology (OAT)
State of California
Sacramento, CA
Contact: Dave Rozell

42. People United for Self-Help
5208 South 13th Place
Phoenix, AZ 85040
Contact: Bob Lawson

43. San Bernardino West Side Community Development Corp.
1736 West Highland Avenue
San Bernardino, CA 92411
Contact: Valerie Pope

44. San Mateo Development Center
1671 Bay Road
East Palo Alto, CA 94303
Contact: Ida Berk

REGION X: Alaska, Idaho, Oregon, Washington

45. Clackamas Community College
19600 S. Molalla Avenue
Oregon City, OR 97045
Contact: Ken Roberts

46. Independent School District of Boise
1207 4th Street
Boise, ID 83702
Contact: Patsy Kim

MATRIX OF PROJECTS CONTACTED

Note: All projects had students as a target group. However, some of the projects had specialized target groups which are shown below.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
TARGET GROUPS																																														
youth offenders involvement																x					x														x			x							x	
low-income involvement										x		x				x	x								x																x	x			
senior citizen involvement												x						x										x							x											
community organizations involvement	x			x			x					x	x					x								x		x		x			x	x					x	x				x	x	x
local business involvement			x				x				x		x		x																			x		x				x						
working with local government							x																																						
EDUCATIONAL APPROACHES																																														
vo-tech			x				x																	x									x													x
continuing adult education				x								x								x						x								x									x			x
multi-disciplinary energy ed. programs (K-12)				x																		x	x						x												x				
technician training programs																											x														x					
educational program for teachers	x																								x											x										x
students teaching students approach					x					x				x									x																							
MEDIA/COMMUNICATION APPROACHES																																														
student organized/conducted workshops					x					x												x	x	x		x											x									
school energy fairs	x														x						x	x	x												x		x		x							
traveling energy fair																																x														
traveling slide show	x									x		x																x		x					x		x							x		
provides speakers on energy topics											x		x																	x		x		x		x								x		
solar energy demo van/bus											x													x								x														
coverage in local press/TV	x		x				x								x	x	x						x	x	x		x	x															x		x	
mobile energy exhibit																							x									x				x										
radio show production																						x		x																					x	
film production/video																					x																			x						
energy conservation booklet production		x						x													x			x			x						x				x									
school energy calendar production																					x																									
develop city/state demo/resource center				x																		x									x									x					x	
tours/open house to public of projects built																x							x	x																				x	x	
plays on energy topics																																x					x									
puppet shows on energy topics																																					x									
theme trailers on energy topics								x																																						
alternative energy library												x											x										x													
organized workshop sessions among schools											x																												x							
field trips for students		x			x					x																										x										
community energy surveys													x																																
energy audit training		x		x				x		x														x										x					x							
weatherization techniques taught				x	x					x			x	x					x			x								x		x	x						x			x	x			x
recycling center																			x																			x						x		
energy poster contests												x																																		
energy essay contests												x																																		
solar collector contests																																	x													
energy booklet for poor readers		x																																												
SOLAR PROJECTS																																														
solar greenhouse construction			x		x	x						x				x		x	x	x			x	x	x			x	x		x															x
greenhouse horticulture						x						x				x		x	x	x			x					x	x		x			x	x											x
gardening projects												x						x																								x		x		
solar hot water heater construction			x				x	x								x							x	x	x	x	x					x	x								x	x		x		
solar food driers, solar oven construction															x								x		x			x	x																	x
hot air solar collector projects							x								x		x		x			x	x		x		x		x			x	x		x										x	x
solar retrofitting to buildings							x																						x		x		x								x	x		x		
industrial solar applications																																											x			
low-cost solar home construction																x											x														x					
build test equipment for solar projects			x																				x				x														x					
OTHER HANDS-ON ENERGY PROJECTS																																														
school experimental laboratory								x															x				x																			
underground building construction																						x																								x
wood heat instruction																																	x													
methane digester construction															x								x					x																		
windmill construction			x						x														x																						x	
composting experiments									x										x																											
lighting conservation										x																																				

CHAPTER VII

SOURCES OF FUNDING

The following describes sources of funding that have been used or are potentially available for use by CAAs. Most energy education projects have been funded through federal programs, though some have also used state and, to a lesser degree, local and private resources. Most sources of federal funding listed here have been used by one or more of the energy education programs contacted, with the exception of HEW's Community Education program and DOE's Faculty Development, Materials Development, and Public Education programs, which, although possible sources of funding, did not fund any of the Energy Education programs located by this study.

This list is by no means exhaustive. Often there are obscure funding possibilities within agencies in both the federal and state bureaucracies, and there may well be others that have not been discovered during this study. Also, funding directions and styles frequently change in short periods of time, and will probably have changed somewhat between the time this guidebook was researched and its publication date. Some funding information on the better known sources may be found in the Department of Education's yearly Selected Guide to Federal Energy Education Assistance, or in the yearly Catalog of Federal Domestic Assistance. Perhaps the most current funding information, however, may be obtained from the regional assistance organizations listed below, or from energy education organizations themselves, especially those with multiple sources of funding. Another useful listing of funds is DOE's ACT/ONE publication.

A. FEDERAL FUNDING RESOURCES

Federal funding of projects or parts of projects is available to CAAs and schools, either together or separately.

1. Community Action Agencies (CAAs)

The CAA is the most likely grant applicant.

a. Community Services Administration (CSA)

(1) For information about funds available from CSA contact the CSA regional office, or CSA headquarters in Washington, DC, Richard Saul, Office of Energy Programs, 202/632-6503. See also the Catalog of Federal Domestic Assistance, Section 49.014.

(2) CSA State Economic Opportunity Offices (SEOOs): There are 51 SEOOs and, though their structure and responsibilities differ somewhat from state to state, some SEOOs have funded or assisted in the funding of energy education projects. SEOOs may receive CSA and other federal and state funds to operate or delegate the operation of programs to help the poor and may also develop and participate in research and demonstration programs funded by CSA and other sources. R&D activities designed to bring about meaningful changes in state and local government to make these activities more responsive to the poor will have priority. Perhaps Energy Education programs developing strong relationships between the CAA and local government and schools might apply here. Priority is also given to proposals which give evidence that state or other non-CSA funding of the program would be available after a successful demonstration of 1 or 2 years.

For further information, contact the CSA regional office; or CSA headquarters in Washington, DC (Michael T. Blouin, Assistant Director for Community Action, 202/254-6110).

(3) National Center for Appropriate Technology: NCAT, an independent appropriate technology organization funded by CSA, has developed a small grants program ($10,000 or under) to aid in the development of local solutions to energy problems and encourage the spreading of information on small-scale technologies. NCAT has funded projects which try for new approaches to communication. Examples would be traveling road shows, high school appropriate technology clubs, greenhouse projects, an alternative high school offering courses in energy, etc. As one of its grant categories, the agency includes education of local communities in the potential for appropriate technologies and their application to community problems.

For further information on NCAT grants, contact the National Center for Appropriate Technology, P.O. Box 3838, Butte, Mt 59701, 406/494-4572.

b. U.S. Department of Labor (DOL)

(1) Comprehensive Employment Training Act (CETA): Most CSA-funded energy projects, including energy education, depend heavily on the CETA program for staff salaries and trainee stipends. There are three parts (or "titles") to the CETA program, some of which cover adult training and employment programs, while others cover youth. CETA programs are administered by CETA prime sponsors, which are units of general local government (i.e., cities and counties with populations of 100,000 or more); a unit or combination of units of government which the Secretary of Labor determines is appropriate; and the 50 states. Although occasionally CAAs function as prime sponsors, usually they subcontract with prime sponsors for CETA positions.

Title IV is the CETA title which involves community-based youth programs. Title IV has three parts.

Youth Incentive Entitlement Pilot Projects (YIEPP) go to CETA prime sponsors who guarantee part-time employment or training during the school year for a maximum of 20 hours a week for from 6 to 9 months, and/or summer employment for at least 8 weeks (maximum of 40 hours per week) to poor 16- to 19-year-olds from selected target areas who are already in school or who will be returning to school. As this program is set up as a scientific experiment with specific results looked for, funds granted under this program go directly to a limited number of prime sponsors. Large-scale community organization involvement in the program is limited.

The Youth Community Conservation Improvement Program (YCCIP) funds conservation and improvement projects which provide unemployed 16- to 19-year-olds in and out of school with employment, work experience, skills training, and community service opportunities for up to 12 months. This program emphasizes developing and providing jobs. Young people are encouraged to remain in school or to return to school if they have dropped out. If the youths are still in school, the program schedule must be set up around the time they spend in school. YCCIP funds are allocated to states and native American groups, and prime sponsors must apply to them for funds. YCCIP prime sponsors, in their turn, must seek out project applications from local community groups, notify them of the deadline for project applications, and give them priority for funds.

The Youth Employment and Training Program (YETP) provides training and employment to unemployed in-school poor and near-poor 16- to 21-year olds, to better their chances of getting jobs. When they fund YETP program operators, prime sponsors are supposed to give special consideration to "effective community-based groups," and to ensure that those groups are actively involved in the overall planning for YETP programs.

Also authorized under Title IV is Summer Programs for Economically Disadvantaged Youth (or SPEDY). SPEDY provides employment, training, counseling, and job preparation during the summer, for poor young people who are 14 to 21 years old. CETA prime sponsors and native American groups are eligible to apply; other community groups apply to the prime sponsors as grantees. For information where to contact CETA prime sponsors in your area, contact the Employment and Training office in your region.

For further information contact Office of Youth Programs, Employment and Training Administration, U.S. Department of Labor, 601 D Street, N.W., Washington, DC 20213, 202/376-2649.

c. ACTION

(1) Volunteers in Service to America (VISTA): The VISTA program sends volunteers into low-income communities to help improve living conditions. Volunteers are persons from all walks of life and all age groups who work full-time for one or two years on allowances at the level of and among the people they serve. Low-income, locally recruited volunteers may be assigned to work in their home communities, and/or in teams with nationally recruited volunteers. Much work done currently by VISTA volunteers involves energy and appropriate technology, because they encourage self-help and community empowerment. Energy education activities are legitimate areas for VISTA volunteer activity.

Community organizations may apply for and become sponsors of VISTA volunteers. Sponsor organizations must be non-profit organizations, may be public or private, and include state and local governments. VISTA projects must be poverty related.

Prospective sponsors should apply through VISTA program offices in ACTION Regional Offices. No matching funds are required for VISTA projects. Size of an operating grant depends entirely on the number of volunteers involved in the project. In 1978, approximately 4,560 volunteers served in 500 projects, an average of 9 per project.

For information on ACTION Regional Offices, call VISTA, (toll free) 1-800-424-8580, ext. 26 or 38. In Washington, DC, dial 254-6880.

d. U.S. Department of Commerce/Federal Regional Action Planning Commissions

There are seven Regional Action Planning Commissions. Within their regions, these commissions evaluate development needs and priorities, develop comprehensive long-range economic development plans based on local, state, and federal priorities, and promote economic development through public and private investment. The Commissions have authority to develop demonstration projects in areas such as energy (including energy conservation and development), transportation, health, and vocational education.

The New England Region contains all the New England states. The Coastal Plains Region includes 290 counties and 17 separate cities in the North and South Carolinas, Georgia, Florida, and Virginia. The Upper Great Lakes Region consists of 119 counties in Michigan, Minnesota, and Wisconsin. The Ozark Region consists of Arkansas, Louisiana, Missouri, Oklahoma, and Kansas. The Old West Region contains the states of Montana, Nebraska, the North and South Dakotas, and Wyoming. The Four Corners Region contains the states of Arizona, Colorado, New Mexico, Nevada, and Utah. The Southwest Border Region consists of 36 counties in California, Arizona, New Mexico, and Texas. The Pacific Northwest Region consists of Washington, Oregon, and Idaho. States not mentioned are not included in any region.

If your project is located in one of these regions, information on the possibilities of funding parts of energy education projects is available from your Regional Commission Office:

New England	J. Joseph Grandmaison, Federal Cochairman Main Commerce Building, Room 2606 Washington, DC 20230 202/377-4343
Coastal Plains	Claud Anderson, Federal Cochairman 1725 K Street, NW, Suite 413 Washington, DC 20006 202/634-3910
Upper Great Lakes	William R. Bechtel, Federal Cochairman Main Commerce Building, Room 2093 Washington, DC 20230 202/377-2845
Ozark	Patsy Ann Danner, Federal Cochairman Main Commerce Building, Room 2099-B Washington, DC 20230 202/377-2572
Old West	George D. McCarthy, Federal Cochairman 1730 K Street, NW, Suite 426 Washington, DC 20006 202/634-3907
Four Corners	Gary Blakeley, Federal Cochairman Main Commerce Building, Room 1898C Washington, DC 20230 202/377-5534
Southwest Border	Cristobal P. Aldrete, Federal Cochairman 1111 20th St., NW, Suite 306 Washington, DC 20036 202/634-3917
Pacific Northwest	Patrick J. Vaughnan, Federal Cochairman 444 N. Capitol Street, Suite 122 Washington, DC 20001 202/633-7458

e. U.S. Department of Justice/Law Enforcement Assistance Administration (LEAA)

(1) Office of Juvenile Justice and Delinquency Prevention (OJJDP) Special Emphasis Prevention and Treatment Programs: OJJDP's Special Emphasis Projects are national pilot projects to develop community-based alternatives to the institutionalizing of youthful offenders. OJJDP, for FY 81-82, will continue to fund initiatives to combat the problem of youthful offenders. Diversion projects include, but are not limited to, alternative education, employment counseling, etc., in place of putting youthful offenders into institutions. Energy projects are one possible area into which youth offenders may be diverted.

Projects are funded from 1 to 2 years. Note that OJJCP funds sometimes require a 10% cash match. Funds may be awarded to public and private non-profit agencies, organizations, individuals, and state and local units of government.

For further information on special emphasis projects, contact Office of Juvenile Justice Delinquency Prevention, 633 Indiana Avenue, N.W., Washington, DC 20531, 202/724-7755.

f. U.S. Department of Housing and Urban Development (HUD) Community Planning and Development (CDA)

(1) Community Development Block Grants (CDBGs): CDBGs ought to be considered solely a source of supplementary funding or matching grant money for energy education programs. Only units of government at the local, county, and state levels are eligible applicants for CDBGs, although non-profit agencies may operate CDBG programs under contract with eligible applicants. Communities within Standard Metropolitan Statistical Areas (SMSAs) are mandated by Congress to receive 80% of CDBG funds. These include urban counties with over 250,000 people, cities over 50,000, and central cities. The remaining 20% of CDBG funds are reserved for non-metropolitan communities which must compete for small cities grants.

In general, CDBGs permit a variety of housing development and rehabilitation activities, including acquisition, housing rehabilitation, code enforcement efforts, etc. In addition, CDBGs pay for certain economic development activities and other types of activity carried out by community non-profit organizations. Energy conservation has recently been permitted as a new focus for CDBGs.

Unless your unit of government already has a CDBG or is preparing to apply for one, this type of grant is not a likely source to fund sections of energy education programs. If your area has or is likely to get a CDBG, however, some part of it may be used to provide stipends for school-age youth involved in weatherizing or other housing or energy-related projects.

No matching funds are required of CDBG grantees, and grants, though annual, may be continued beyond 1 year until projects are completed.

Information about CDBG grantees in your area may be obtained from your HUD Area or Regional Office or from the Office of Community Planning and Development, 451 7th Street, S.W., Washington, DC 20410, 202/755-6587.

2. Schools

For the following cases, the school is the more likely grant applicant.

a. U.S. Department of Education (ED)

(1) Environmental Education Grants: ED's Environmental Education program funds research, development, pilot, and demonstration projects which teach about the relationship between human beings and natural and man-made environments. Such projects include the relationships among population, resource allocation, conservation, technology, and economic impact.

Activities supported through this program include the development of curriculum materials, the training of educational and non-educational personnel, and the conduct of community and elementary and secondary education projects. Mini-grant projects support workshops, seminars, and conferences to help communities understand a local environmental problem or issue.

Applicants may be state or local educational agencies, other public and non-public private educational agencies or organizations (including libraries and museums), and institutions of higher education. Applicants must have been organized and active for at least one year before they may apply.

Grants awarded have ranged in size from $700 to $200,000, and the average grant size is $35,000. Approximately 100 projects are funded in a fiscal year. Curriculum development, mini-grant workshop projects, evaluation, and dissemination (including national demonstration projects) are eligible for 100% funding, although projects other than these kinds must provide 20% matching funds for the first year, 40% of first-year costs the second year, and 60% of first-year costs the third year.

For more information, contact the Office of School Improvement, Department of Education, Washington, DC 20202, 202/245-9231.

(2) Community Education Grants: ED's Community Education program funds state and local educational agencies to provide educational, recreational, cultural, and other services in line with the needs, interest, and concern of the community. Projects cover subject areas that are identified by communities (through surveys, committees, etc.) as important, and often involve collaboration with community resource organizations like CAAs.

Grants awarded have ranged in size from $7,800 to $81,800, and the average grant size has been $37,793. State or local educational projects must provide 20% matching funds to establish the program, 35% to expand or improve a program during the first year, and 45% to expand and improve the program in any fiscal year after that. If the program is not improved, but keeps as it was when it started, the state or local project must provide 60% matching funds from the first year on. Joint funding may be established between this program and other related federal programs.

For more information, contact Community Education Program, Office of School Improvement, Department of Education, Washington, DC 20202, 202/245-0691.

(3) Consumer Education Program: Energy Education activities may play some part in consumer education programs funded by ED, although the entire program must focus on wider consumer issues beyond energy. Among other activities, ED funds the establishment of new, or the expansion of existing, pilot or demonstration consumers' education programs in elementary or secondary schools, institutions of higher education, or in community programs potentially serving persons of all ages within the community. Groups served by this program include students; teachers and other educational personnel; public service personnel; community and labor leaders and employees; government employees at the state, federal, and local levels; low-income persons; persons with limited English-speaking ability; Native Americans; and elderly persons.

Grants awarded have ranged in size from approximately $4,500 to $190,000, with the average grant being $45,448 in FY 78. Institutions of higher education, state and local educational agencies, and other public and private non-profit agencies, organizations, and institutions (including libraries) are eligible to apply. Other than projects in consumer education curriculum development or dissemination, which require a 20% matching contribution in funds or in kind, consumer education projects require no matching grants. Joint funding may be established between this program and other related federal programs.

For more information, contact Director, Office of Consumer's Education, Office of School Improvement, Department of Education, Washington, DC 20202, 202/659-5983.

(4) Energy and Education Action Center (EEAC): Activities supported through the Center include technical assistance and information provided to schools, post-secondary, and other educational institutions to promote energy conservation in educational facilities, assistance, and encouragement of the development or adoption and dissemination of supplementary curricular materials. Other activities include the encouragement and support of in-service training of teachers and administrators in areas dealing with energy conservation, and identification and support of programs in career and vocational education which address energy-related employment opportunities.

Grant authority applicable to Center objectives can be found in the Education Amendments of 1978. However, no appropriation has been made through FY 80.

For more information, contact the Office of School Improvement, Energy and Education Action Center (EEAC), Department of Education, Washington, DC 20202, 202/472-7777.

b. U.S. Department of Energy (DOE)

(1) Institutional Building Grants Program, Schools and Hospitals Program: Over the next 5-6 years, approximately $950 million will be available through this program to schools and hospitals that want to do energy audits and install energy conservation/weatherization materials. Approximately $25 million will be available for audits, with the rest going for equipment purchases, engineering analyses, etc.

The grant program is administered through state energy offices. Within each state, no less than 30% of the state's funding is to go to schools, with no less than 30% to hospitals, while the remaining 40% is split up among schools and hospitals according to the state's priorities.

The state energy offices set priorities as to which schools get weatherization grants, and follow state as well as federal guidelines in doing so. For information on obtaining such a grant, contact your state energy office, or Frank Stewart, Director, Office of Institutional Conservation Programs, Department of Energy, Washington, DC 20585, 202/252-2198. He can also provide you with a complete list of State Energy Offices.

(2) Education Division, Office of Consumer Affairs: DOE conducts two programs through its Education Division which might provide auxiliary funding or assistance to energy education programs: the Faculty Development Program and the Materials Development Program. For further information concerning DOE's education activities and available funding, see Activities of the U.S. Department of Energy in Education, Annual Status Report FY 1979, April 1980, DOE/CA-0002.

The Faculty Development Program provides colleges or university centers with funds to conduct summer workshops in energy education for elementary, high school, and community college faculty. Workshop subjects include introduction to energy as an issue, a world energy overview, solar energy, etc. Possibly a school and/or CAA active in energy might collaborate with a local college/university center to develop a format for a summer workshop, or persuade the college/university center to apply for funding for such a workshop to interest local teachers in energy as a prelude to an energy education program.

The Materials Development Program provides colleges, university centers, and/or educational organizations funds to develop and disseminate energy education materials for use in schools. Perhaps a CAA/school effort might be made, along with a college/university center as principal applicant, to get a grant of this type to develop one or more curriculum approaches to low-income energy problems.

For more information on these programs, contact Education Division, Office of Consumer Affairs, DOE, Mail Stop 7E054, Washington, DC 20585, 202/252-6480.

(3) Energy Extension Service: DOE's Energy Extension Service has offices in every state, territory, and possession. Intended as an energy outreach program responsive to local needs, it was established to encourage individuals and small establishments to reduce energy consumption and convert to alternative energy sources.

In some states, energy education has already become an important part of the extension service program. In 23 of Michigan's 83 counties, for example, the extension service Youth Education Program conducts educational activities and learning-by-doing activities for young people and their parents. It also works with high school students through energy fairs, theater groups, through the creation of posters, publications, and displays. High school students also conduct home and transportation energy audits with their families.

Perhaps a CAA/school effort, or a coalition of such efforts, might establish a joint program with, or apply for funding from, a state energy extension service. Information on Energy Extension Services may be obtained from your state branch of DOE, or from Mary Fowler, Director, Energy Extension Service, Department of Energy, Mail Stop 2H027, Washington, DC 20585, 202/252-2300.

B. STATE AND LOCAL RESOURCES

In general, state funding resources are limited compared to federal resources and, where they exist, are specific enough to each state to make a comprehensive list of possible state resources too unwieldly to list here. Because of these difficulties, the following information covers just those general sources at the state level from which more state-level information may be obtained.

Within the state, the Office of the Governor can usually provide referrals to potential funding sources. In some states, CETA regulations permit the set-aside of a percentage of the total CETA state grant to be used by the Governor for funding special discretionary projects. In California, for example, Governor's Discretionary Funds have been used to develop solar training and other energy projects. The State Department of Energy may be interested in low-income energy education programs or already conduct them, or a State Office of Appropriate Technology, if one exists (as in California and Massachusetts), might be a source. Often State Departments of Education have energy education departments or money which can be used for summer teacher workshops or other instructional purposes. In Nebraska, a CAA persuaded the State Board of Education to run a series of summer workshops on energy education. State Energy Extension Services may also be possibilities, as noted above. Occasionally, State Councils of the Humanities, where they exist, may serve as funding sources for projects dealing on the humanist level, for example, with value/ethical choice questions about our energy future.

In general, to discover possibilities for funding on the state level or interest state officials in such programs, it might be helpful to look for state programs which are similar to those federal programs mentioned earlier, or which have similar target groups. For example, youth, vocational, public education, volunteer, employment, senior citizens, and other programs on the state level might provide sources of funding.

Local funding possibilities are often more limited than even the state projects. Occasionally, an area may have a county-level office of appropriate technology, as in Lane County, Oregon, which may serve as a possibility. In large cities, city departments similar in subject area to those federal and state departments referred to before might be possibilities. In Chicago, for example, the City Office of Senior Citizens provided some of the funding for a greenhouse project involving both seniors and young people. In smaller areas, sometimes a local government can be persuaded to set aside its own tax money for energy education projects of benefit to the whole community. In Somersworth, New Hampshire, the town council supported an effort by the High School Vocational Program to build a solar-heated firehouse.

It must be stressed, however, that, because state and local resources are limited, only in rare cases will they provide more than supplementary funding to federal grants. Nevertheless, in an environment in which federal efforts are shrinking or subject to sudden cutoffs, the project that has many sources of funding has the best chance of survival.

C. PRIVATE FUNDING SOURCES

1. Foundations

Private foundations are funding sources which, though potentially promising, have not been used very much by energy education programs. Several foundations exist, however, which may be plausible sources of funding for community organizing and youth projects around energy. For further information, send $6.95 plus 15% postage and handling to the Center for Renewable Resources, 1001 Connecticut Avenue, NW, Fifth Floor, Washington, DC 20036, or call 202/466-6880, for _Sources of Funds for Solar Activists_, Second Revised Edition, by Anita Gunn. Another good source of information is the _1977 Network of Change-Oriented Foundations_, compiled by the Playboy Foundation, 919 N. Michigan Avenue, Chicago, IL 60611, free. _How to Apply to a Foundation_ (Report Series No. 50) contains a fine short description of how to write a proposal most effectively, and a good list of foundations to contact. Send $0.60 plus $0.15 postage to Citizens' Energy Project, 1110 Sixth Street, NW, Suite 300, Washington, DC 20001, or call 202/387-8998.

2. Utilities, Corporations, Unions, and Other Organizations

On occasion, private organizations have provided some funding for energy education programs. In some states, more often in the West, public utilities have funded parts of energy education programs. Usually such utilities are owned by some branch of government, or have been subjected to political pressure by government or lobbying groups, or are in rare instances sympathetic.

Private corporations sometimes donate money to community-based programs. McDonald's, for example, donated $3,500 to the Christian Action Ministry Greenhouse in Chicago. Oil companies, like Exxon or Mobil, sometimes contribute to energy education programs. Response from programs holding Exxon grants indicates that few if any strings are attached to the money; in other words, recipients do not have to teach Exxon's point of view.

Labor unions represent an almost completely untried source of funds for such programs. You should search out union locals or offices in your area to see what possibilities exist.

Local service clubs like Lions or Rotary are possible sources of support for energy education efforts. They often donate money to support new community projects, provide sponsorship and/or volunteers for events like energy fairs (serving as exhibit judges, directing traffic, selling tickets, etc.), and encourage their members who are local businessmen to cooperate by donating materials. Most service clubs in smaller cities actively seek out new community service projects.

CHAPTER VIII

RESOURCES FOR ENERGY EDUCATION PROJECTS

The purpose of this chapter is to provide readers with useful introductory information on available resources for energy education. It is oriented to those who wish to participate in this field, design and develop projects, construct solar devices, instruct others how to do so, mobilize the necessary community support, develop networking mechanisms, obtain additional training and technical assistance and engage in related activities.

The good news for readers is that there has developed in the last five years a significant body of individuals, organizations and agencies working in the field of energy conservation and renewable energy resources development that may serve as resources to those entering the field. Unfortunately there are so many resources that this guidebook does not have the space or time to list them all. Rather, this appendix will serve its purpose if it gives the readers initial direction so that they can pursue their resource needs individually and independently. Readers are thus encouraged to explore the following general sources of information:

A. GENERAL INTRODUCTION TO RENEWABLE ENERGY RESOURCES

- Alternative Sources of Energy, bi-monthly magazine. Route 2, Box 90-A, Milaca, Minnesota 56353. $15.00 per year. This periodical covers topics on solar, wood, methane, and other renewable energy sources as well as food sources. Many backyard and neighborhood energy/food projects are discussed. It is an exceptional magazine by the people (and for the people) actually experimenting with renewable energy alternatives. Energy workshop and conference announcements, book reviews, interviews, and regular columns (e.g., on wind energy) are featured. If you are serious about renewable energy alternatives, you could not subscribe to a better magazine.

- Energy Book #1, edited by John Prenis (1975). Running Press, 38 South 19th Street, Philadelphia, Pennsylvania 19103. $4.00 ($.25 postage). Solar water heaters, homemade wind generators, backyard bio-gas plants are some of the topics in this book. Technical, semi-technical, and funky articles are informative and enjoyable to read. To quote the editor, John Prenis, "This book is respectfully dedicated to all the backyard experimenters and basement tinkerers who have shown that alternative energy research need not be the exclusive domain of 'experts.'"

- Energy Book #2, edited by John Prenis (1977). Running Press, 38 South 19th Street, Philadelphia, Pennsylvania 19103. $5.00. An extension of Energy Book #1 with a sampling of the alternative and renewable energy field. More technical in nature than Energy Book #1, however. The articles include a methane bus, operating experience with an experimental heat pump system, solar house design, a recording anemometer, working toward a wind powered homestead, and more.

- Energy for Survival, by Wilson Clark (1974). Anchor-Doubleday, 501 Franklin Avenue, Garden City, New York 11530. $4.50. An historical analysis of the changing cultural demands for various types of energy. In short, the book tells you how the energy crisis developed, why we have a crisis, and what energy alternatives are open to us. A very well-documented book which stresses strongly and logically that we have very little time left. If a friend says, "I don't believe we have an energy crisis," send him a copy of this book.

- Energy Primer, by Portola Institute (1974), 558 San Santa Cruz Avenue, Menlo Park, California 94025. $5.50. In the format of the Whole Earth Catalog, there are reviews of products and books plus descriptive articles on wind, solar, water, bio-fuels (wood, methane, alcohol), integrated systems and more. Although the book is called a "primer," it is very comprehensive. There are plenty of diagrams, charts, and photos. It is a source book much like a renewable energy "yellow pages," presenting ideas and products for the energy-conscious shopper.

- In the Bank or up the Chimney, by U.S. Housing and Urban Development Administration (1976), c/o GPO, Washington, DC 20402, Stock No. 023-000-00411-9, $0.70. A somewhat useful booklet on ways to conserve and winterize your house. You are shown how to calculate heat loss and how to conduct your own energy audit of your home. Tips and suggestions on insulation, storm windows, etc.

- Kilowatt Counter, by Gil Friend and David Morris (1975), Alternative Sources of Energy, Route 2, Box 90-A, Milaca, Minnesota 56353. $2.00. A general explanation for the layman about what energy is, how it is measured, and its various forms (kinetic and potential). If you are not sure what a Btu is, or you do not quite understand what a kilowatt is, this booklet would be helpful to you. Some of the topics are: heat units, mechanical units, electrical units, power, converting between units, net energy, and energy as applied to solar, wind, and biomass energy sources. Kilowatt Counter is an easy way to learn about energy without have to take a physics course.

- Low-Cost Energy-Efficient Shelter for the Owner and Builder, edited by Eugene Eccli (1976), Rodale Press, Inc., Book Division, Emmaus, Pennsylvania 18049. $10.95 (hardback), $7.95 (paperback). Comprehensive, well-illustrated how-to-do-it book covering all aspects of home building and renovation for energy conservation and passive solar heating. Over 400 pages, bibliography, glossary, and 50 pages of designs and plans. Precise information on financing, building codes, problems, and site planning as well as solar water heaters, solar greenhouses, passive solar houses, ventilation, etc., makes this book outstanding in this field of literature.

- Other Homes and Garbage: Designs for Self-Sufficient Living, by Jim Leckie, Gil Masters, Harry Whitehouse, Lily Young (1975), Sierra Club Books, 530 Bush Street, San Francisco, California 94108. $9.95. A very well-written and well-research text (despite the levity of the title). Most of the renewable energy resources that could be implemented on a backyard level are discussed: solar, wind, hydropower, methane digesters, and chapters on agriculture and aquaculture. Some of the strongest chapters from an informational standpoint are on insulation, calculating heat loss, water power, and bio-gas (methane) production. Technically, this is a more comprehensive book than the Energy Primer, but that is because it is more academically oriented. A highly recommended book on renewable energy sources with fine illustrations, it belongs in everyone's energy reference library.

- People and Energy, a monthly periodical, 1757 "S" Street, N.W., Washington, D.C. 20009. $10.00 per year. This is an excellent periodical briefly covering events, projects, conferences, and people on a nationwide basis as related to nuclear energy, solar energy, and various appropriate technologies. Usually, one in-depth article is included in each newsletter on an up-to-date subject.

- Producing Your Own Power, edited by Carol Hupping Stoner (1974), Rodale Press, Inc., Book Division, Emmaus, Pennsylvania 18049. $8.95. A very straightforward, easily read handbook on the use of renewable energy alternatives. Highly recommended.

- Rainbook: Resources for Appropriate Technology, by Rain (1977), 2270 Northwest Irving, Portland, Oregon 97210. $7.95. Details on composting toilets, woodstoves, solar greenhouses, solar collectors, wind energy systems, etc.

- Save Energy: Save Money, revised edition (1977), Community Services Administration (CSA Pamphlet 6143-5). Order free-of-charge from National Center for Community Action, 1328 New York Avenue, N.W., Washington, D.C. 20005. Illustrated 48-page pamphlet covering energy conservation in many aspects, including caulking and insulation, designs for thermal curtains, how to build a solar wall heater and a solar window heater, how to improve a fireplace design, building an air-lock porch. Written in an easy-to-read manner. Could be very useful as an educational tool to junior or senior high school classes or as a giveaway for students to take home to parents.

B. SOLAR ENERGY

- Direct Use of the Sun's Energy, by Farrington Daniels, Ballantine Books, P.O. Box 505, Westminster, Maryland 21157. $2.20. This semi-technical book provides sound, basic information on solar energy. It is still considered one of the best solar energy books around.

- Feasibility of an Energy-Related Loan Program for Low-Income Homeowners, by Eugene Eccli, for the Community Services Administration, 1200 19th St., NW, Washington, DC 20506, (1977), free. This study explores the fiscal and technical feasibility of creating an interest-subsidized federal loan program to assist low-income homeowners in retrofitting their homes for solar energy to reduce energy bills. Researchers would find the calculations and conclusions useful.

- Gasohol (Report Series No. 24), by Ken Bossong (1978), Citizens' Energy Project, 1110 Sixth Street, N.W., Washington, D.C. 20001. Discusses the feasibility of alcohol fuels in terms of historical use, current research and development efforts, applications, costs and prospects. Includes bibliography and references.

- Homeowner's Guide to Passive Solar Retrofit (Report Series No. 2), by Ken Bossong (1978), Citizens' Energy Project, 1110 Sixth Street, N.W., Washington, D.C. 20001. Provides introductory information and resources for homeowners, including direct gain, indirect gain, and miscellaneous options.

- Solar Age, a monthly magazine, Solarvision, 200 East Main Street, Port Jervis, New York 12771. $20.00 per year. A very good periodical with articles for the novice and technician. Interviews, book reviews, and information on solar-related legislation as well as pertinent reports on up-to-date solar projects.

- Solar Energy Digest, a monthly periodical, S.E.D., Box 17776, San Diego, California 92117. $28.50 per year.

- Solar Engineering, a monthly periodical, Solar Engineering, 8435 North Stemmons Freeway, Suite 880, Dallas, Texas 75247. $10.00 per year. Technical but interesting. Reviews of solar homes, products, and manufacturers listed often.

- The Solar Home Book, by Bruce Anderson with Michael Riordan (1976), Cheshire Books, Church Hill, Harrisville, New Hampshire 03450. $7.50. Perhaps one of the best books on solar energy for the layman. Simple, easy to read, and informative. Passive and active solar systems are described with a special focus on individuals who have already built and tested solar-heated homes, solar water heaters, etc. Although this is not a "nuts and bolts" (construction) text, it will certainly provide you with a basic understanding of the application and theory of solar heating. This book should be one of the first books a solar novice obtains for his reference and background reading.

- Solar Resources (Report Series No. 29), by Ken Bossong (1978), Citizens' Energy Project, 1110 Sixth Street, N.W., Washington, D.C. 20001. Describes resources to anyone interested in solar research or applications, including private organizations, government organizations, solar directories, solar bibliographies, and solar energy newsletters and magazines.

- 30 Energy-Efficient Houses . . . You Can Build, by Alex Wade (1977), Rodale Press, Emmaus, Pennsylvania 18049. $10.95 (hardback). The solar assisted homes described in this beautifully illustrated book rank as possibly the best designed passive solar shelters being built in this century. The book is well worth every penny, especially for anyone serious about going solar.

C. WIND ENERGY

- Electric Power from the Wind, by Henry Clews (revised edition)(1975), Solar Wind Publications, P.O. Box 7, East Holden, Maine 04429. $2.00. A booklet in non-technical language describing the "whys," "whats," and most particularly, the "hows" of wind generator systems. General introductory reading, but very informative nevertheless.

- The Homebuilt, Wind Generated Electricity Handbook, by Michael Hackleman (1975), Earthmind, 5246 Boyer Road, Mariposa, California 95338. $10.00. A truly valuable "nuts and bolts," step-by-step book on the reconditioning of discarded wind generators. The table of contents includes: (1) Expeditions; (2) Wind Machine Restoration; (3) Towers; (4) Installing the Wind Machine; (5) The Control Box; (6) Auxiliary Electricity - Generating Equipment; and (7) Wind Machine Design Notes. This book is a logical follow-up to Hackleman's previous book, Wind and Windspinners.

- Simplified Wind Power Systems for Experimenters, by Jack Park (1974), Helion, Box 4301, Sylmar, California 91342. $6.00. An excellent book describing the power output and advantages and disadvantages of various windmill/wind generator designs. How the airfoil blades work is described as well as a method of graphing different airfoils is presented. This is a recommended book for individuals who want to obtain a semi-technical guide to wind generator design. The steps Jack Park outlines are: (1) determine the power needed, (2) determine the wind energy available; (3) determine the configuration and size of windmill required to obtain power required from energy available; and (4) design the components of the windmill to satisfy aerodynamics and structural requirements.

- Wind and Windspinners, by Michael Hackleman. Earthmind, 5246 Boyer Road, Mariposa, California 95338. $7.50. An extremely informative book about the construction of a Savonius rotor. However, it also covers subjects such as alternators, care and charging of batteries, testing of used batteries, regulators, wiring, etc. Complete and clear.

- Wind Power Climatology of the United States, by Jack W. Reed, U.S. Energy Research and Development Administration, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830. $7.60. Wind data from 758 stations. Data analyzed for average wind speeds during the month, season, and year.

- Wind Power Digest, published by M. Evans. A quarterly periodical. Wind Power Digest, 54468, CR 31, Bristol, Indiana 46507. Subscription, $8.00 per year (4 issues). This is perhaps the best periodical on windmills/wind generators presently available. Articles are technical and non-technical in nature ranging from interviews with wind researchers to specific plans for building wind generators. Reviews of books, products, and wind power legislation are of common occurrence in each issue. A very informative Wind Power Digest is the Wind Access Catalog Fall 1977 (mentioned in test), available for $2.00. This issue lists distributors of batteries, wind towers, wind generators, and anemometers.

D. EDUCATION AND TRAINING IN SOLAR ENERGY

- National Solar Energy Education Directory (1979), prepared by the Solar Energy Research Institute, Golden, Colorado for the U.S. Department of Energy. Available from Superintendent of Government Documents, U.S. Government Printing Office, Washington, D.C. 20402. Provides descriptions of about 700 U.S. educational institutions offering courses and programs in solar energy.

- Reaching Up, Reaching Out, Solar Energy Research Institute (SERI), Golden, Colorado.
This guide to organizing local solar events first describes 13 energy events that local communities can do, providing useful background information on "what made it happen," "what happened," and the recommended audience. The "organizing primer" section of this manual introduces readers to "developing an idea for the event, building a core planning group, motivating volunteers, building a budget and raising the money to cover it, and spreading the word of your plans." The Resources section includes an index for easy use, an extensive list of publications in the field of active solar, bibliographies, consumer protection, directories, domestic hot water, energy conservation, greenhouses, organizing manuals, passive, policy, weatherization, wind, and wood. Lists of newsletters, magazines, sources of free or inexpensive information are also provided, in addition to the names, addresses, and phone numbers of energy-related organizations across the United States. This publication will be available in August 1979. Direct inquiries to the Document Distribution Center, Solar Energy Research Institute, 1536 Cole Boulevard, Golden, Colorado 80401 or call 303/231-1158.

- HUD Solar Status (September 1978: HUD-PDR-189-11, U.S. Department of Housing and Urban Development, Washington, D.C. 20410). A very useful publication listing sources of training for installing solar devices. Is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

- Installing Solar: Training Expands to Meet the Need. This six-page booklet includes the names, addresses, and short descriptions of approximately 30 organizations and institutions that provide training and education for solar installation across the United States. Included in its scope are two-year solar programs, short courses, home study opportunities, installation aids, and suggestions for further information.

E. EDUCATION AND TRAINING IN ENERGY CONSERVATION

- The Neighborhood Volunteer Association and Consumer Protection, Energy Conservation Division, focuses its activities on problems and needs of non-governmental organizations involved with housing, consumer affairs, and neighborhood development. One of the Energy Conservation Division's objectives is to develop innovative educational tools and communications events to heighten consumer awareness about energy conservation.

For more information contact Mr. Bradley Ziff, Neighborhood Volunteer Association and Consumer Protection (NVACP), Office of Consumer Affairs, Energy Conservation Division, Room 3174, Department of Housing and Urban Development, 451 7th Street, S.W., Washington, DC 20410.

F. RESOURCES FOR TEACHERS

- Annotated Bibliography Teaching Aids, Cranston Community Action Program Committee, Inc., 30 Rolfe Street, Cranston, Rhode Island 02910. This CAA has prepared a 15-page booklet of resources to assist community energy education efforts.

- Bibliography of Energy Education Materials, Citizens' Energy Project, 1110 Sixth Street, N.W., Washington, D.C. 20001. A descriptive bibliography of 35 publications in the field of energy education.

- Energy Education Materials Inventory, published by Energy and Man's Environment, Inc., Portland, Oregon, c/o National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161, Order No. PB 260-480 (five-volume set), $19.00.

- Energy Education - A Bibliography of Citations from Current Index to Journals in Education (CIJE) 1966-1978, compiled by Milton Rinehart, Robert Howe, and M. James Kozlow. Available from the Science, Mathematics and Environmental Information Reference Center, 1200 Chambers Road, Third Floor, Columbus, Ohio 43212. $5.00 This publication contains annotations and indices to selected articles announced in CIJE from 1966 to 1978. The compilation is designed to serve as an effective tool to assist teachers, researchers, curriculum developers, librarians, administrators, and others concerned with science education. Supplements will be issued periodically.

- Guide to Jobs and Energy (1978). This 22-page booklet describes the relationship between energy and the economy and the substitution of energy for labor. Other topics include energy inefficiency and waste, social effects of large-scale technologies, energy efficiency and jobs, and solar-based employment prospects. Available from Environmentalists for Full Employment, Room 305, 1101 Vermont Avenue, N.W., Washington, D.C. 20005.

- N.E.E.D. Starter Packet, N.E.E.D. Headquarters, Region #6. P.O. Box 12, Earlton, New York 12058. The packet offers 11 introductory level pamphlets covering energy art, home environment conservation, industrial arts and energy, energy and social studies and related subjects. A twelfth pamphlet describes the National Energy Education Day (March 21, 1980) and related energy education efforts.

- Energy on Film, by New York State Alliance to Save Energy, Inc., 36 West 44th Street, Room 709, New York, New York 10036 (2.2/840-8383). A bibliography of more than 160 films on energy, energy sources, issues and options, the energy crisis, energy conservation, and energy and the environment.

- Proceedings of the Second Annual Practitioners Conference on Energy Education, 1980. Limited copies are available at $3.00 from Project for an Energy-Enriched Curriculum, National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, DC 20009, 202/328-5800.

- Reel Change: A Guide to Films on Appropriate Technology. Soft-Aware Inc., P.O. Box 93, Hadley, Massachusetts 01035 (413/584-3209). Comprehensive review of 84 films on alternative energy, organic agriculture, and community self-reliance. $3.50.

- Solar Energy Curricula (1979). Set of curricula developed by New York State Education Department and the State University of New York at Albany, funded by the U.S. Department of Energy. Covers grades 7-12. All units are available from the U.S. Government Printing Office, Washington, D.C. 20402.

#061-000-00228-6	Activities: Junior High School	$2.75
#061-000-00229-4	Activities: Chemistry & Biology	2.20
#061-000-00230-8	Activities: Biology	1.70
#061-000-00231-6	Activities: General Solar Topics	2.50
#061-000-00232-4	Activities: Earth Science	2.75
#061-000-00233-2	Solar Energy Text	2.75
#061-000-00234-1	Solar Energy Teacher's Guide	2.20
#061-000-00235-9	Solar Energy Reader	2.75

The following materials are available from the Center for Renewable Resources, 1028 Connecticut Avenue, N.W., Washington, D.C. 20036.

- Solar Energy Education Bibliography (1979). Provides extensive bibliography for energy education at elementary, secondary, and college levels. Audio-visual section includes a list of distributors, films, videocassettes, slide shows, and filmstrips.

- Solar Energy Education Packet for Elementary and Secondary Students (1979). Interdisciplinary solar energy packet designed to make solar studies understandable and interesting. Includes necessary background information, passive and active systems, energy conservation, solar activities for student participation, and a bibliography.

The following materials are available free of charge from the U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830:

- Award Winning Energy Education Activities for Elementary and High School Teachers (1977). This 38-page booklet contains brief descriptions of prizewinning entries in the National Science Teachers Association (NSTA) Teacher Participation Contest conducted in 1976. The contest sought ideas that would fit easily into standard (science and non-science) courses of study at various grade levels to further student understanding of important energy issues.

- Energy Films Catalog. Describes more than 190 motion pictures that are available for free loan.

These two publications are available free from the U.S. Department of Energy, Distribution, Office of Administration and Services, Washington, D.C. 20545.

- Careers in Energy Industries (1975). A 12-page pamphlet which identifies the skills needed to build and operate energy facilities as the job market expands to accommodate increased production, transportation, and processing of energy. Also includes job skills involved with conservation practices and installation of conservation materials.

- Organizing School Energy Contests (1975). Brochure explaining how to organize a local community energy contest through the schools.

The following materials are available from the National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009:

- Energy-Environment Materials Guide, Stock No. 471-14694, $2.00.

- Energy Environment Mini-Unit Guide, Stock No. 471-14696, $3.00.

- Energy-Environment, Volume 2 - Energy, Its Extraction, Conversion, and Use. Stock No. 471-14692, $4.00.

- "Fact Sheets." These four-page fact sheets are free with a stamped, self-addressed envelope. For multiple orders, enclosed $1.00 to cover mailing costs. Order by number as well as by title.

1. Fuels from Plants (Bioconversion)
2. Fuels from Wastes (Bioconversion)
3. Wind Power
4. Electricity from the Sun I (Solar Photovoltaic Energy)
5. Electricity from the Sun II (Solar Thermal Energy)
6. Solar Sea Power (Ocean Thermal Energy Conversion)
7. Solar Heating and Cooling
8. Geothermal Energy
9. Energy Conservation: Homes and Buildings
10. Energy Conservation: Industry
11. Energy Conservation: Transportation
12. Conventional Reactors
13. Breeder Reactors
14. Nuclear Fusion
15. New Fuels from Coal
16. Energy Storage Technology
17. Alternative Energy Sources: Environmental Impacts
18. Alternative Energy Sources: A Glossary of Terms
19. Alternative Sources: A Bibliography

G. ENERGY EDUCATION CURRICULA/CLASSROOM MATERIALS

1. Primary Grades

The following entries are available free of charge from the U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830:

- The Energy We Use (Grade 1). 1977. 41 pages. Study units include: "Energy in Wind," which involves a pinwheel parade to show the energy of the wind; and "The Sun," in which students watch two plants to see how the sun gives them energy.

- Community Workers and the Energy They Use (Grade 2). 1977. 80 pages. In units such as "What is Energy?", students explore the energy forms of light, heat, and motion. In 'Community Workers Who Work Directly with the Sources of Energy," students look at the farmer, grocer, oil man, gasoline station attendant, and others.

- Energy and Transportation (Grade 3). 1978. 89 pages. Using classification activities, picture studies, and other development approaches, students learn about transportation in the neighborhood, community, and nation. Field Test Draft.

The following are available from the U.S. Department of Energy, Distribution, Office of Administration and Services, Washington, D.C. 20545:

- Energy Activities with Energy Ant (Grades 1-3). 1975. 28 pages. A coloring-game book to tell children about energy and how to use it wisely. English and Spanish editions. Free copies for class use.

- Energy Ant Posters: The Wind and Sun; The Diamond (Coal); The Hare (55 mph). 17 x 22. Color. Free.

- My Energy Book (Grades 1-3). 1978 Rev. 28 pages. A reader that tells children about energy and how to use it wisely. Free copies for class use.

The following is available from the National Audio-Visual Center, Order Section, NAVC, Washington, D.C. 20409 (make checks payable to National Archives Trust Fund):

- Energy Ant Film Strip Set (Grades 4-6). 1976. Two-part color film strip with sound cassettes: "What is Energy?" (10 minutes) and "What is Energy Conservation?" (6 minutes). Includes teacher guides. $12.50.

2. Upper Elementary

The following are available free of charge from the U.S. Department of Energy, Technical Information Center, Oak Ridge, Tennessee 37830:

- Bringing Energy to the People: Washington, D.C. and Ghana (Grades 6, 7). 1978. 80 pages. This interdisciplinary unit provides a comparative overview between cultures that establishes two concepts: that energy is a basic need in all cultures; that energy use affects the way people live. Field Test Draft.

- Networks: How Energy Links People, Goods, and Services (Grades 4 and 5). 1978. 100 pages. Six interdisciplinary lessons that investigate energy networks, such as electrical circuits, sources, conversions, and end use consumption. Field Test Draft.

- Science Activities in Energy (Grades 4-6). 1977. A series of simple, hands-on science experiments that are designed to help students learn about various forms and sources of energy. File-folder units have the following titles:

  "Chemical Energy - Science Activities in Energy" (26 pp.)
  "Conservation - Science Activities in Energy" (28 pp.)
  "Electrical Energy - Science Activities in Energy" (30 pp.)
  "Solar Energy - Science Activities in Energy" (23 pp.)

- Your Energy World (Grades 4-6). 1978. Consists of four file-folder units. The first is an overview explaining energy resources and problems. The other three emphasize energy-saving opportunities in transportation, the home, and the school. Contains a total of 18 spirit duplicating master student activity sheets, teacher guides and background, and a wall chart in color.

3. Junior High School

The following are available free of charge from the U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830:

- An Energy History of the United States (Grades 8 and 9). 1978. 117 pages. Charts the growth of American energy use and traces the history of the major sources of energy in the United States. Field Test Draft.

- Energy Conservation: Understanding and Activities for Young People (Grades 7-9). 1975. 20 pages. Discusses the meaning of energy, its sources and limitations, and suggests conservation activities.

- Energy, Engines and the Industrial Revolution (Grades 8 and 9). 1977. 82 pages. Study units include "The Giant Step of the Industrial Revolution," a student reader covering the years 1700-1860 with focus on energy; and "The Great Joule Robber" in which the contribution of the heat engine (gasoline and diesel engines and steam turbines) to the Industrial Revolution is described.

- Mathematics in Energy (Grades 8 and 9). 1978. 72 pages. This packet is designed to infuse energy into junior high math classes. The unit deals with a wide range of energy math including conversions, statistics, and the manipulation of energy units (Btus, watts, calories, etc.). Field Test Draft.

- Transportation and the City (Grades 8 and 9). 1977. 46 pages. Study units include "Shut Down by Tin Lizzie," a student reading exercise showing how small American towns decline as a result of the automobile; and "The City of Windshields," which describes Los Angeles, the city that the automobile built.

4. Senior High School

These are available free of charge from the U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830:

- Agriculture, Energy, and Society (Grades 10-12). 1977. 36 pages. Interdisciplinary unit helps students examine the nature of present-day agricultural methods and study the impact of these methods on existing energy resources.

- Energy Conservation in the Home: An Energy Education/Conservation Curriculum Guide for Home Economics Teachers. 1977. 335 pages. This resource book will help home economics students learn how to conserve energy in their homes and lives.

- Energy in the Global Marketplace (Grades 9-11). 1978. 64 pages. Explores the role of energy in world trade and in the global balances of power. Examines the major energy "haves" and "have-nots," and investigates the process by which energy prices are determined. Field Test Draft.

- How a Bill Becomes a Law to Conserve Energy (Grades 9, 11, 12). 1977. 118 pages. Study units include "Case Study of a Bill," which describes how the 55-mph national speed limit became a law and takes the student through the lawmaking process; and "A Congressional Hearing" in which students play typical roles at a hearing on a national speed limit bill in a simulation game.

- U.S. Energy Policy - Which Direction? (Grades 11 and 12). 1978. 92 pages. Designed as a companion to How a Bill Becomes a Law to Conserve Energy, this unit concentrates on the executive branch of government and the various forces that go into making energy policy. Field Test Draft.

5. Post Secondary

- Fundamentals of Solar Heating. 152 pages. Study Guide. 112 pages. 1978. Books are designed for use in a home study course for hvac contractors but could be useful to teachers of adult education technical courses. Books free to educators. Available from U.S. Department of Energy, Solar Technology Transfer Branch, 600 E Street, N.W., Room 400, Washington, D.C. 20545. Course enrollment for certification comes through the Home Study Institute, 1661 West Henderson Road, Columbus, Ohio 43220, 614/459-2100. Cost is approximately $100.

H. FEDERAL ASSISTANCE TO ENERGY EDUCATION

- The Energy and Education Action Center (EEAC) of the U.S. Office of Education has produced a useful 22-page booklet entitled A Selected Guide to Federal Energy and Education Assistance which describes energy-related assistance provided by the federal government in the areas of curriculum/materials development; direct student assistance; employee/teacher training; facilities improvement; outreach to public/business sectors; research, development, demonstration, data collection and dissemination; and assistance to local, regional and state governments for innovative projects. This booklet covers the programs of ACTION, Community Services Administration, Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Office of Education, Department of Health, Education, and Welfare, Department of Housing and Urban Development, Department of Labor, and the Tennessee Valley Authority.

This document is available from the EEAC, U.S. Office of Education, Room 514, Reporters Building, 300 - 7th Street, S.W., Washington, D.C. 20202 (202/472-7777).

- Another useful resource document is Activities of the Department of Energy in Education, Annual Status Report FY 1978, (DOE/IR-0038), January 1979, available from U.S. Department of Energy, Assistant Secretary for Intergovernmental and Institutional Relations, Office of Education, Business and Labor Affairs, Washington, D.C. 20545.

This 16-page booklet provides details on DOE's energy education and related programs including: Faculty Development Program; PREFACE Program (Pre-Freshmen and Cooperative Education for Minorities and Women in Engineering); Laboratory-Cooperative Program; Materials Development Program; Special Projects in Energy Education and Training; Public Education Program; Used Energy-Related Laboratory Equipment Program; and Vocational-Technical Education Program.

- A document in the same series (DOE/IR-0008, March 1978), subtitled A Description of Programs for Schools of the Department of Energy and Its Predecessor Agencies, provides useful information on training, curriculum development, educational special events, and facilities support resources for energy education, as well as information on the activities of the energy extension service in seven states.

I. TECHNICAL ASSISTANCE - RESOURCES AND ORGANIZATIONS

- An excellent work well worth the modest investment is the Citizens' Energy Directory, published by the Citizens' Energy Project, 1413 K Street, N.W., Washington, D.C. 20005, 1978, 108 pages and appendices. $7.50. It lists over 500 individuals, organizations, and agencies that may provide assistance, including technical consulting, to energy education projects. Each is described by name, address, phone, contact person, organization size, type of organization, purpose and goals, areas of interest, services provided, and significant publications. Each entry is then listed alphabetically by state.

The appendices are also very useful, listing the basic entries by type of organization including: citizen action/community groups; manufacturers/small industry/publishers; consultants/design/architects/distributors; schools/research/educational groups; government - state, federal, and city; industry/utilities/construction; and newsletters/magazines.

Finally, the directory provides additional information in a separate section on these areas: appropriate technology, solar newsletters and magazines; wind; geothermal; and citizen energy newsletters.

- Appropriate Technology - A Directory of Activities and Projects, by Integrative Design Associates, Inc. for the National Science Foundation, and available from the National Technical Information Service (NTIS), Document Sales, U.S. Department of Commerce, Springfield, Virginia 22161. A useful document for those seeking technical assistance. Chapter One describes projects and their activities in the fields of energy and housing, bio-agricultural activities, and community organizing and the cooperative development of skills, while Chapter Three presents a Washington resources list. Chapter Four provides a bibliography under these categories: general reading; energy and housing; agriculture and land use; community development; appropriate technology and developing countries; and sources of continuing information.

- National Center for Appropriate Technology (NCAT) provides technical assistance and support to low-income community projects in appropriate technology and renewable energy applications, in part through workshops and training sessions. Contact: P.O. Box 3838, Butte, Montana 59701 (406/494-4572).

- National Solar Heating and Cooling Information Center provides basic information on solar energy, written in layman's terms, including lists of names and addresses of architects and builders specializing in solar energy in your area, solar bibliographies, and the latest information on government services and resources near you. The center operates a toll-free hotline (800/523-2929) or you may write to: P.O. Box 1607, Rockville, MD 20850.

The following are organizations which can provide information on specific people or organizations able to help in developing energy education projects within your area:

- Northeast Appropriate Technology Network, Inc. serves the New England area, New York, and New Jersey as a resource organization which people consult for referrals to individuals who may provide technical assistance, and offers a limited amount of technical assistance (which it intends to expand). NATN runs the Valley Community Resource Center which has an extensive energy and environment library open to the public. NATN also runs the Franklin County Energy Project which published and presently distributes the Franklin County Energy Study, and has a touring slide show and talk for schools and other groups. NATN published New Roots Magazine, a bi-montly publication which covers community self-reliance efforts in the Northeast. Contact: Patricia Greene, Northeast Appropriate Technology Network, Inc., 70 Federal Street, P.O. Box 548, Greenfield, MA 01302 (413/774-2257).

- Middle Atlantic Appropriate Technology Network (MATNET) is an association of citizens groups, small businesses, local government officials, individual citizens, and others interested in promoting the application of appropriate technologies in the Middle Atlantic states. MATNET covers a region that includes the states of West Virginia, Virginia, Delaware, Maryland, the District of Columbia, Ohio, Pennsylvania, Kentucky, New York, and New Jersey. The network exists to aid in the exchange of ideas, information, and skills in the Middle Atlantic Region. MATNET seeks to assist local groups and individual activists to develop effective community programs through referrals to resource people, suggestions on fund-raising, organization building, etc. Contact: Ken Bossong, MATNET, 1110 Sixth Street, N.W., Suite 300, Washington, D.C. 20001 (202/387-8999).

- Southeast Energy Technical Group (SETG) is a non-profit corporation active in research and development and provides technical assistance in appropriate technology and self-sufficiency to community action groups and others. SETG serves Federal Region IV, which includes Georgia, Alabama, Florida, North Carolina, South Carolina, Kentucky, Mississippi, and Tennessee. SETG also deals with passive solar applications in constructing housing for low- and moderate-income groups, and in helping poor people to become energy self-sufficient. Contact: Paul Muldawer, A.I.A., 3904 Randall Ridge Road, N.W., Atlanta, Georgia 30327 (404/261-8726 or 404/881-8066).

- Mid-American Solar Energy Complex (MASEC) is a regional organization serving the states of the North and South Dakotas, Nebraska, Kansas, Missouri, Iowa, Ohio, Minnesota, Wisconsin, Illinois, Michigan, and Indiana. In part, its responsibilities involve the enhancement of public awareness and understanding of solar energy and conservation, providing programs for direct technical assistance to small businesses, educational institutions, organizations, and individuals, and providing educational resources specifically for the Mid-American region. Contact: Norm Harold, Mid-American Solar Energy Complex, 8140 26th Avenue South, Bloomington, Minnesota 55420 (612/853-0400).

- Midland Energy Institute is a non-profit, private corporation which has been funded for the past three years through CSA. Midland Energy Institute provides training and technical assistance in all aspects of energy work for CAAs as well as other public and private energy-related organizations, particularly in Missouri, Iowa, Nebraska, and Kansas, but has provided services to other states as well.

In addition to weatherization, Midland also provides assistance in energy education, design and construction of alternative energy services. The Institute has developed training materials for weatherization crew members, foremen, trainers, and managers. MEI also has a one-hour comprehensive slide/sound show available for purchase on weatherization training. MEI has an energy reading room, as well as a slide library of projects in their region. Contact: George Elsasser or Steve Gallaher, Midland Energy Institute, 1221 Baltimore Avenue, Suite 1100, Kansas City, Missouri 64105 (816/842-2459).

- New Mexico Solar Energy Association (NMSA) carries on research and development projects, community solar construction projects, and provides technical assistance in all aspects of solar energy to the Southwest, to the nation, and to some degree, internationally. NMSA is currently providing assistance in energy education activities, supports affiliates in the state and the region, and has carried on a teacher training program that teaches vo-tech teachers about solar hardware construction, as well as a curriculum development program. NMSA also has a program which talks to kids of all levels about solar. They have been in several projects involving Indian reservations. NMSA distributes several publications on how-to, hands-on activities, has an extensive slide show, and organizes state and regional solar conferences. NMSA stresses its role as a small-scale organization providing assistance to other small-scale organizations as partners. NMSA is a membership organization. Members obtain a monthly magazine called "Sunpaper," and reduced charges on any contracted services. Contact: Steven Meilleur, New Mexico Solar Energy Association, P.O. Box 2004, Santa Fe, New Mexico 87501 (505/983-1006 or 505/983-2887).

- Office of Appropriate Technology (OAT) promotes appropriate technology for the public and state government of California by forming a network of appropriate technology practitioners, holding seminars, disseminating information, developing energy conservation programs for residential application, alternatives for waste management, etc. Contact: Gigi Coe, Office of Appropriate Technology, P.O. Box 1677, Sacramento, California 95808 (916/445-1803).

- Ecotope Group is a non-profit corporation doing research, demonstration projects, and education for renewable energy techniques and conservation active in the Pacific Northwest. They have done research with anaerobic digestion, and passive solar design for heating residences and greenhouses. They operate an energy resource center which has probably the largest library in the Northwest on conservation and renewable energy information. They do hands-on and seminar training with solar water heaters and greenhouses, and have set up training programs for SUEDE, OIC in Seattle, and done direct training and curriculum development for OIC and Antioch College West. They have renewable energy and conservation slide shows which cover the state-of-the-art in the Northwest. They also act as design consultants for private parties. Contact: Belinda Boulter, Ecotope Group, 2332 E. Madison, Seattle, Washington 98112 (206/322-3753).

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